

Artificial Intelligence



How it Changes the
Future

Sachin Ramar

VISIT...

LANZAROTE
Caliente.COM

Artificial Intelligence

How It Changes the Future

By
Sachin Ramar

* * * * *

Copyright © 2019

This book is available in print at most online retailers.

All rights reserved. No part of this publication may be reproduced or distributed in any form or by any means, electronic or mechanical, or stored in a database or retrieval system, without prior written permission from the publisher.

Table of Contents

[Introduction](#)

[What Is Artificial Intelligence?](#)

[Machine Learning](#)

[How Bots Learn](#)

[Genetic Breeding Model or Evolutionary Model](#)

[AI and the Internet of Things](#)

[Opportunities for AI](#)

[Threats of AI](#)

[How AI is Deployed in Industries](#)

[How We Can Work With AI](#)

[Machines Helping Humans](#)

[AI and Ethics](#)

[Ethical AI](#)

[Conclusion](#)

Introduction

Now days, we are all surrounded by modern interconnected devices. Those devices have access to the entire world, and they are as small as your palm. Just a few centuries ago, the ability to talk to someone thousands of miles away or produce a clear image of China while you are living in the United States was considered to be witchcraft. It is almost magical for people back then to think that it is possible for a group of people to talk face-to-face without being physically together. Now, these superpowers are taken for granted. Not many people can appreciate such wonders these technologies have brought to our lives. Technological advancement has brought us very far indeed. We made things a lot easier for us, for we are both social and lazy creatures. We discovered medicine and anatomy so surgeons can operate on patients and cure disease more effectively. Then, we thought that operating by hand is too hard, so we invented a device that helps surgeons operate on patients. We evolved from walking on four legs to two legs. Back then, legs were the best form of transportation, until we invented a way not to walk through the creation of iron horses (cars) and metallic tube that is heavier than air but can soar high like the birds. Now, it may sound even mundane to talk about how planes fly, but try to explain that to the people in the medieval age how they managed to get thousands of people around the globe in about three days and you can see their brain explode.

We cannot deny just how useful technology has been in our lives. As mentioned earlier, we have taken them for granted. We care less about how it works than what it does. Everything has its own price, after all. There are many examples in the past. Misuse of medicine leads to the evolution of horrendous diseases known as superbugs. People abuse drugs meant to

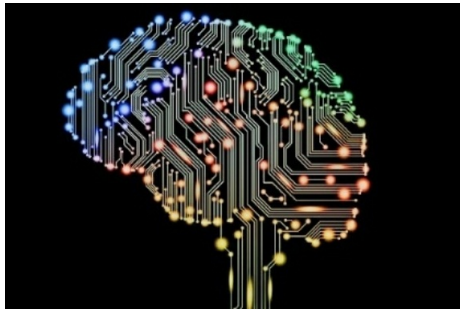
relieve pain. Communication, while allowing a teenager to talk to his long-distance girlfriend thousands of miles away, takes him away from his family members sitting just feet away from him at the dinner table. Horses initially thought to be the best Wi-Fi you can have before the invention of telecommunication and cars, now became obsolete. Factory workers, fishermen, as well as farmers, are being replaced with machines at an alarming rate. They cannot compete against machines that can do a lot more work for a fraction of the cost both money and time-wise. Therefore, you cannot deny that technological advancement brings with itself the change in society and the way of life as a whole.

Among these advancements, one sparked a significant concern. artificial intelligence. Many old movies depicted how machines can turn against their own creators, and such references can be heard tossed around in many discussions about Artificial Intelligence. Sure, they were initially joking, but everyone cannot dismiss the fact that it could happen. On a more serious note, people saw what technology did to horses. People start to worry if they will be next on the technological chopping block. Certain famous figures such as Elon Musk and even Stephen Hawking also warned everyone about the development of artificial intelligence.

According to Stephen Hawking, AI development could be the worst event in the history of mankind civilization unless we find a way to control its development. He stressed the fact that, theoretically, computers can emulate humans' intelligence and eventually exceed it. It is very possible when you think about it. Machines are not limited by physical biological barriers. They are only limited to the hardware that is installed, which can easily be upgraded for a boost in capacity much greater than that of biological evolution.

As it stands, AI lives among us. They are in smartphones; they help people find information; they also learn the behaviors of their owners and produce relevant contents to enhance their user's experience and encourage them to continue using the device. Some people are actually right to be concerned when AI is deeply entrenched like this. In this book, we will discuss AI in detail, including its history, how it works, and how it influences the society.

What Is Artificial Intelligence?



The word itself consists of “artificial” and “intelligence”. Artificial is something that is simulated, not real, but also not fake in the sense of being a scam. The best way to describe artificial is by thinking of the grass used to cover the stadium ground. That is artificial grass, but it functions similarly to real grass. It is a lot easier to care for, more resistant and is widely used in many sports. The point is, artificial objects can be used instead of the genuine things because the former is better in certain situations. Intelligence is a complex term. You can say that it is the logic, self-awareness, learning, emotional knowledge, conscience, planning, creativity, the list goes on. Humans are the most intelligent species because we have something that all other animals lack. We can perceive our environment, comprehend, understand, and take actions based on what they learned. You can say that animals can do just the same to a certain degree. However, our brain evolved exponentially until we invented language to

communicate better with others, as well as tools to interact better with our environment. We also invented weapons so we can climb up the food chain until we are at the top as the dominant species. Both humans and animals have natural intelligence. We develop this naturally through the tedious evolutionary process.

While the existence of intelligence in plants is debatable, it is proven that they show their intelligence differently from humans or animals. Plants do not have a brain or any neural network, but they are still fully capable of reacting to their environment. A perfect example of this is a study in which a flower is grown inside a dark box with only a small hole through which sunlight could go through. As the flower grows, it leans toward the light, indicating that plants too can react to their environment although they do not have any nervous system. Intelligence observed in plants is an intriguing topic of its own because it is not as easily observed as that in humans or animals.

Now, there is another type of intelligence known as artificial intelligence. Broadly speaking, it is the simulation of human intelligence process using machines. Such intelligence is found in computer systems. AI has some characteristics similar to human intelligence such as planning, problem-solving, knowledge representation, motion, learning, and many other things. There are two main types of AI: narrow AI, and general AI.

Narrow AI is found in computers. These AIs learn and are taught to how to carry out specific tasks without being programmed explicitly how to do so. A perfect example is speech and language recognition capability in Siri, which is a virtual assistant in iPhones. Another example is the vision-recognition systems in self-driving cars or the AIs that works behind the curtain that delivers advertisement on websites that are relevant to viewers

based on their search history and internet activities. These AIs are called narrow AI because they can only learn or taught how to do a specific task. Narrow AIs can do many things such as interpreting video feeds from surveillance drones or mundane tasks such as organizing personal and business documents. They are capable of responding to customer's questions and coordinating with other AIs to book a hotel room at the right price and location. They have also been used in advanced applications such as spotting potential cancer tumors in X-rays, detect wear and tear in elevators or flagging inappropriate contents online.

On the other hand, general AI is an entirely different entity. It has the same adaptable intelligence found in humans, unlike narrow AI that can only learn to do one thing. This flexibility allows general AIs to build spreadsheets, give you a haircut, and drive without crashing into people. This is the sort of AIs displayed in Terminator the movie. So far, though, it does not exist yet and AI experts are still debating whether it will ever be a reality.

According to a survey conducted in 2013 by AI researchers, philosopher Nick Bostrom, Vincent C Mullet, as well as four other groups of experts, reported a solid 50% chance that AGI (Artificial General Intelligence) would be developed between 2040 or 2050. Even if that is not the case, then the chances are up to 90% by 2075. According to the survey, the emergence of superintelligence is also predicted. According to Bostrom, superintelligence is an intellect that far exceeds human cognitive performance by a long shot, in all domains of interest. Its emergence is expected to be just 30 years after the development of AGI.

Still, those are just speculations and many AI experts are still skeptical about this projection. Their main reasoning is that we still do not understand our own brain. So, it is theoretically impossible to develop

anything that imitates the human brain. AGI may still be a few centuries away from us. Whatever side you take, there is one event that put the AI's capability in the spotlight for the general public.



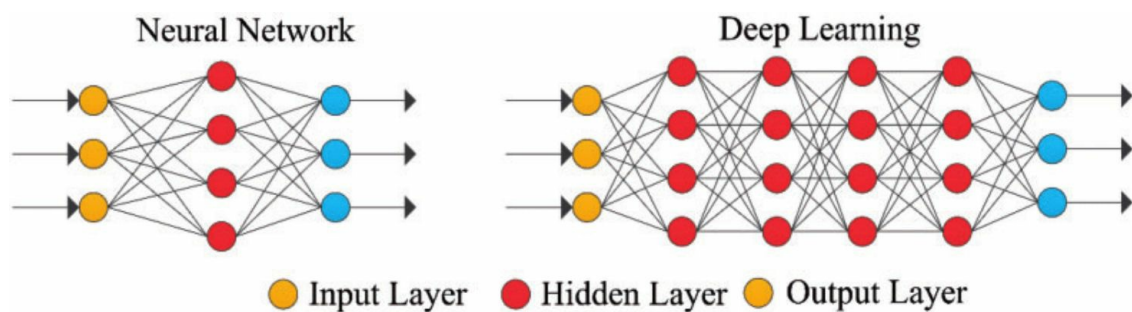
Back in 2017, there was a demonstration of the capability of AI. OpenAI, an Elon Musk-backed startup, created AIs that could defeat the world's best Dota 2 players. Dota 2 is an impossibly complex game in which two teams of five players compete to destroy each other's base. Because there are over 100 playable characters with their own unique abilities, not to mention that there are dozens of items with unique effects of their own, it is impossible to comprehend the complexity of the game because there are literally millions of different combinations that a player can choose from. Because of this complexity and competitiveness, it is one of the most famous e-sports in the world with annual tournaments held by Valve. In that year, there was a surprise segment in which finalists have to compete against a bot from OpenAI. According to the engineers from OpenAI, the bots learned enough about the game to beat professional players although it took time. During that time, the bot amassed a lifetime of experience by utilizing a neural network, not to mention that it runs several instances of itself in accelerated game simulation to speed up the learning process. It all began with only a few instructions. The bot was told that dying is bad, doing damage to the enemy is good, etc. Then, the bot

learns to explore the surrounding, learn the in-depth mechanics of the game and eventually become competent enough to compete against professional human players with a relatively high degree of success. Again, the bot learned enough to match the skill of world-class gamers in just two weeks whereas the human players themselves took several years just to get to where they are today. Plus, it is no simple game of tic-tac-toe either. It is a game of strategy and planning with overwhelming complexity. This is a good enough example to demonstrate the frightening capability of AI through machine learning. So, what is machine learning?

Machine Learning

It is a process in which a bot gathers a lot of data before comprehending and learn how to perform a certain task based on the data given. Through machine learning, the bot is able to recognize speech and caption a photo. The key is neural network.

The Neural Network



It is inspired by the brain because both share certain traits. In the neuron network, there are several interconnected layers of algorithms or codes called neurons. These codes or algorithms feed data into other codes or algorithms to create a complex system that can be trained to carry out specific tasks. All you need is a few simple instructions that highlight certain crucial attributes

to input data when it passes through each layer.

It may sound complicated, and it is. Basically, the neuron networks function just like our brain. Each neuron has a specific task and is connected to the next neuron. It is possible to understand exactly what a neuron in a human brain does. You can take a cluster of neurons and study it, and you might be able to understand its general purpose as many scientists have done. However, the entire human brain is still beyond comprehension. The same could be said for the neuron network in an AI. A single line of code can be studied, and the general purpose of a cluster can be grasped. However, the entire system is a mystery. However, everyone knows that it just works.

There is also a subset of machine learning known as deep learning. Here, neural networks are expanded into many networks with a large number of layers in order to interpret a large amount of data. These neural networks pushed the computing powers of many computers to perform tasks such as recognizing speech and computer vision.

Neural networks have many types as well, and all of them have their own strengths and weaknesses. For example, recurrent neural networks are well-suited to language processing as well as speech recognition, which is found in Siri, the iPhone virtual assistant among other bots. Convolutional neural networks are better-suited for recognizing images, one of which is found in Google Translate in which you can scan an image for words and translate those words. The designs of these neural networks are also evolving as we speak. Researchers are working hard to create a more effective and efficient form of deep neural network called LTSM (Long Short-Term Memory) so that the neural networks have enough computing power to meet the demand of many systems such as Google Translate.

Evolutionary model or evolutionary computation is yet another area

of AI research that uses Darwin's famous theory of natural selection. Survival of the fittest. In this case, survival of the better bot. here, the genetic algorithms undergo completely random mutations as well as combinations between generations in an attempt to create the right solution to a problem. Think of it as giving a thousand monkeys typewriters and they will eventually write Hamlet from Shakespeare. Except, the bots get better and better. We will discuss this more below.

The Resurgence in AI

Perhaps one of the biggest breakthroughs for AI technology research is in the field of machine learning, specifically deep learning. Of course, the research is only successful thanks to how easily data can be collected. Moreover, we have more computing power than ever. During that time, the use of GPU clusters to train machine-learning systems become more widespread.

These clusters are more than just giving computing powers to train machine-learning models, though. They are available widely as cloud services over the internet. Eventually, major tech firms such as Google and Microsoft have moved to utilize specialized chips to run and train machine-learning models. The best example of these custom chips is the one from Google known as Tensor Processing Unit. The latest version allows machine-learning to study information from data a lot faster, not to mention the speed of which bots are trained using the chip. These chips are used to train models for DeepMind and Google Brain, not to mention that the models that underpin the translation capacity of Google Translate and the photo recognition of Google Photos. There are also other services that allow the public to build their own machine learning models using Google's TensorFlow Research Cloud. The second generation of these chips is

unveiled at Google's I/O conference about last year that promises even better speed for Google's machine-learning model used in translation. Here, it is stated that it would take the bots half the time for it to translate compared to a large cluster of high-end graphics processing units.

How Bots Learn

We talked in the last chapter about machine learning. However, if we want to understand the entire process, it is better to illustrate it in real-life events.

On the internet, this artificial intelligence exists in the form of algorithms. The videos you watch on YouTube are brought to you by those bots. When you click on the video, the bots take note. When you go on Facebook, your activity will be tracked by the bots. They will also determine what you will see based on the posts you read, liked, commented, shared, etc. When you buy a plane ticket online, the bots determine the price. They also communicate with more bots at the bank and monitor the transaction to make sure that it is not fraudulent. The stock market is now hardly any more than just hundreds of bots trading among each other in split seconds. Hey, maybe a bot suggested this book to you too!

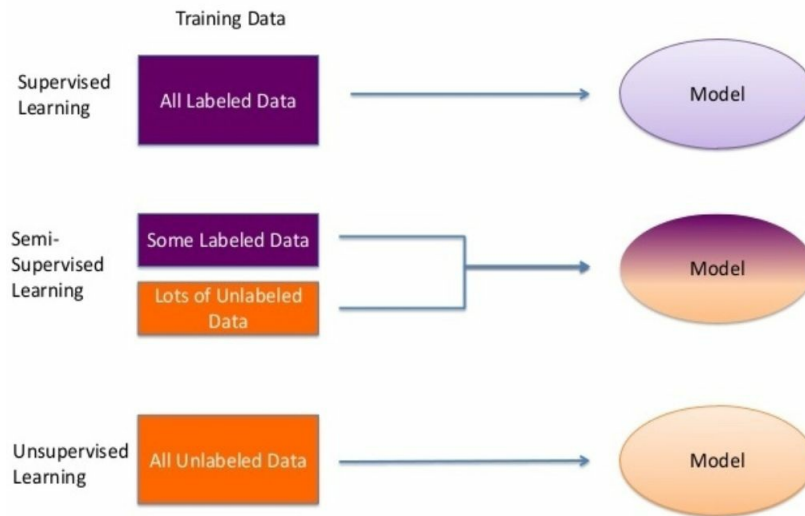
Before, we humans create bots by giving them a bunch of instructions that we can explain. If A, then B. If User clicks on A, then show A1. However, everyone can see the limitation immediately. Certain programs are so vast that it is impossible for us to manually program a bot for it. When you look at the stock market, there are literally millions of transactions going on. How could anyone possibly program a bot to trade reliably in such circumstances? The same could be said for YouTube. There are countless videos out there. How do you program, as in write codes, so that a bot can reliably predict what the user wants to watch next? How do you program a bot that sets the price for the plane ticket just right, so you maximize profit without scaring away the customer? The bots you see are far from perfect, but you should remember that they do a better job than humans, and that is

important.

While those bots can do amazing things, no one really knows how they work. Even their creators do not understand how they function. Still, companies are very protective when it comes to how their bots work because bots are very valuable employees. It is a closely-guarded secret of how bots are built in any company. There are three main categories of machine learning, which are supervised, unsupervised, and reinforced learning.

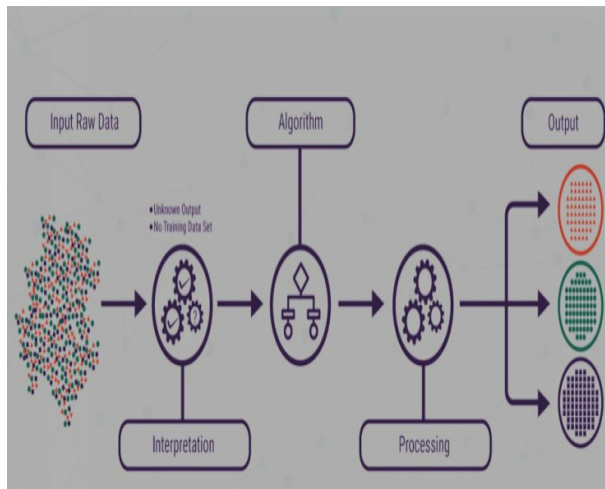
Supervised Learning Model

This is a common method for teaching an AI system. All the bots need is a large chunk of data and labeled examples. You then feed the bots a large amount of data and then give them some time to study the data and highlight the features of interest. Suppose that the bots need to be able to tell the difference between a dog and written words and that the data fed are photos, then the bots will go through the photos and try to understand and differentiate. Here, neither the programmer nor the bots themselves know how they think, but what is known that the bots can do the job over time. When these bots are trained, which means that they can accurately perform their tasks using the labeled examples, then they are capable enough to do the same thing when they are fed raw, unlabeled data, theoretically speaking of course.



This process is known as supervised learning. Of course, creating a bot that can reliably tell the difference between an ice-cream and a snowman is nothing to scoff at. It requires a lot of labeled datasets. It can be millions of images and examples just to get the bot to do one thing right. However, as mentioned earlier, since we have a relatively high abundance of data online, collecting data for the bots is a lot easier than it was a decade ago. The task of creating and labeling examples, however, is a human task. Normally, online workers who are employed through platforms such as Amazon Mechanical Turk will do the hard work. However, a certain company already has a huge amount of data within their hands without the need to outsource. For example, Google's Open Image Dataset that has more than nine million images or YouTube's Youtube-8M which is a labeled video repository containing over seven million labeled videos. ImageNet now has more than 14 million categorized images, being one of the earliest databases now invaluable to machine learning. Datasets are available in large quantity and they are still growing in size. For companies like Google or YouTube, they can train their bots based on the data they already have. Still, many companies now care more about computing power than having access to the labeled database. The same cannot be said for unlabeled datasets, though. More on that later. Recently,

Generative Adversarial Networks have demonstrated how machine-learning systems can create its own fresh data to teach themselves using only a small amount of labeled data. This can be very useful and potentially lead to the rise of semi-supervised learning in which bots can learn to carry out a certain task using only a relatively small amount of data.



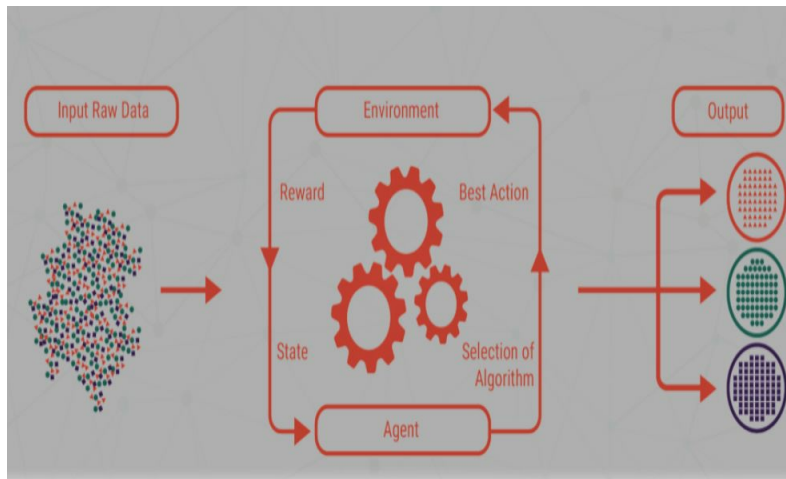
Unsupervised Learning Model

Alternatively, unsupervised learning does not require as much human's involvement. Here, the bots try to find patterns in the data so they can categorize it. A good example here is by clustering fruits that look similar. So, apples go with tomatoes for their colors, or hamsters go with rats for their sizes. It is worth mentioning that the bots are not programmed beforehand to look for a particular set of data. You simply create the bot to learn using the unsupervised learning model, hand it a lot of data, and let the bot try to group and categorize everything by the similarities in the dataset. You can see this in Google News that groups similar stories on a daily basis.

Reinforcement Learning Model

Think of it like giving your pet with some treats after it performs a trick. The only difference is that the pet is a bot, and the trick is the process of getting the desired result and the reward is the outcome itself. Here, the

system attempts to find the best outcome (reward) based on the data you



gave to it. It then continues to work until the best result is achieved.

For example, Google's DeepMind's Deep Q-network has beaten many human players in many classic video games. The bot has been given a large amount of data, even each pixel of the game, and then the system goes on from there. It tries to figure out how to jump so that the character does not fall and die. More advanced features include how to defeat the boss as fast as possible, maximizing the score. For Mario Bros., a famous retro video game, the bot will map a route to guide Mario through each level to collect all the coins, defeat all the monsters, all while completing the level as fast as possible.

What these bots can achieve are nothing short of miraculous. It seems that the sky is the limit. The only limiting factor is data, computing power, and time. With enough of the three, a bot can learn and be taught how to do just about anything. But the question remains: How do they learn? It is possible to understand how they learn without getting into the technical details of the functions of each and every neuron if we study how a bot is built.

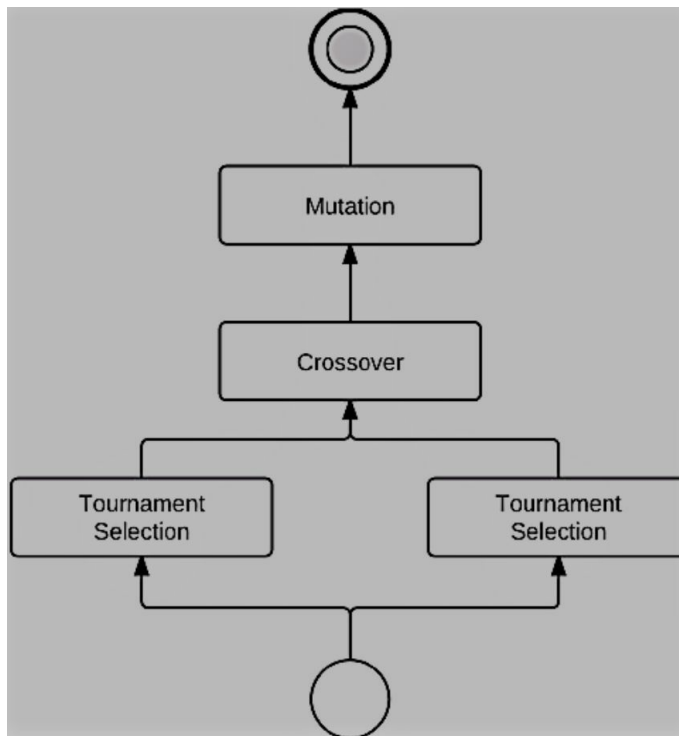
For example, you need a bot that can go through a large number of

photos and then separate them into two groups: cats and lions. It is very easy for us, even for children. But things are not that easy for a bot, and outright impossible for even the best human programmer to tell a bot to understand the difference. We can describe a cat by pointing out the sounds it makes, its size, its appearance, etc. But those are just words, and bots cannot understand words. They read and comprehend algorithms or codes. So, how do you build a bot to tell the difference? You don't have to. Instead, you can build a bot that builds other bots and another bot that teaches those bots. Therefore, the brains of these bots are very simple and something that a human programmer can compile. The path of machine learning branches out from here. There are two main models of how to make machines learn: genetic breeding models, and deep learning and recursive neural networks.

Genetic Breeding Model or Evolutionary Model

Before we proceed, there are two main players we should note. The builder bot that creates bots and tweaks them. Here, the builder bot creates bots (let's call the latter student bots) almost by random other than the few instructions given by the programmer. Then the builder bot just connects wires and modules wildly to create wildly random student bots, which are sent to the teacher bot. This is our second important player in this system.

Now, the teacher bot cannot tell the difference between a cat and a lion either. If it can, then there would be no need for machine learning in the first place. The teacher bot does not teach the student bots how to



recognize and classify data properly. The teacher bot simply tests the student bots. Here, the programmer just gives the teacher bot some photos of cats and lions and an answer key telling the teacher bot which photo is which. Then the final exam begins on day one, just as the student bots come out fresh from the oven, without no orientations whatsoever. The student bots are tasked to classify the pictures to the best of their abilities. Now, because they are built by random, all of them will perform poorly at the test. The results will be sent back to the builder bot, who selects the best bot of the bunch, discards the rest, creates copies of the best bot, and make additional changes. Then, the second iteration of student bots is sent to the teacher bot. The teacher bot hands out the exams, and corrects them, and send the results back to the builder bot, and the builder bot gets back to work again. This cycle continues until the humans are happy with the latest iteration of the bot that can do a job reliably.

Now, this is basically giving monkeys typewriters and hope that they write Shakespeare, as mentioned earlier. While it should not work, it actually does. This is partly possible because the builder bot keeps the best student

bot, deletes the rest, and improve upon the best bot in every generation. The student bot gets better and better after every iteration. Moreover, we are not talking about one student bot or a thousand student bots here. We are looking at an infinite number of student bots and millions of questions that they have to answer. This cycle of building, testing, and discarding continues forever. For the first ten or so generations, the best bots are just lucky because the builder bot just happened to write the correct code or algorithm into its system. However, when you keep what works and continually make tweaks, there will be a time when a student bot can do its job reasonably well. While the student bots are copied and chanced, you can even raise the average test score to make it even harder for the bots to pass and be accepted. This process will churn out a very refined bot that can do the job very efficiently. In our case, it can go through five million photos of cats and lions and classify them with great accuracy and speed. Still, by the time the best student bot is employed to do the job, the internal wiring of codes or algorithms will be impossibly complex. Again, no one knows how the student bot does this, not even the student bot itself knows how it does it. Again, it just works.

Unfortunately, there is still a limitation. The bot still has a narrow AI, meaning that it can only do the job it is taught specifically to do. In our case, the bot can only tell the difference between a cat and a lion. It can scan through photos and classify them correctly, but the bot will be confused when it tries to process a video, or if the photo is upside down. It will also make hilarious mistakes as well. Suppose that a dog is dressed up in a lion costume, we humans can tell it is a pug wearing Simba costume. However, again, the bot cannot “see” that. It will say that the image of a pug wearing Simba costume is indeed a lion, which is clearly wrong. So, how does the human programmer overlord compensate for this error? More test materials, because

(in our example) a million images were not nearly enough. That is why so many companies are obsessed with collecting data. The more data they have available, the longer the tests they can make for the student bots, and the better the bots become. So, more data makes bots more accurate.

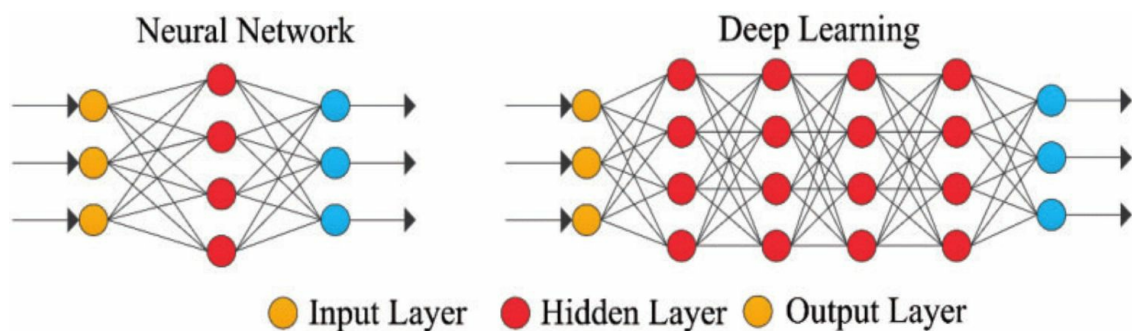
You might be familiar with CAPTCHA (Completely Automated Public Turing test to tell Computers and Humans Apart) tests on certain websites. While you can tell that it is designed to prevent bots from getting into the website, it also has a secondary purpose. These tests are also designed to make you, the website visitors, help build the test with which to test the bots with so they can read, count, and tell the difference between rivers and roads. You might also notice that many CAPTCHA tests nowadays are always about roads, vehicles, signs, storefronts, etc. Since self-driving cars are the current craze all over the world, and every automobile industry is working toward perfecting this technology, you can say that this is no coincidence. The CAPTCHA tests rely on humans to make enough tests that are actually correct, but you do not need to rely on website visitors to build the tests for your bots. There is also another kind of test that makes itself, and it is a test on humans.

For example, suppose that YouTube wants to keep its users watching videos and seeing the ads they are hosting for as long as possible. Where do bots come in? Because it is very easy to measure how long a user stays on the website, the teacher bot simply gives a bunch of YouTube viewers to oversee. The student bots are then tasked to observe the behavior of their assigned humans, take notes of the videos that the humans watched, and then try to find relevant videos so to keep the users watching. The longer the users stay on, the better score the student bot gets. Then, it is just a question of build, test, and rebuilt for several thousand cycles and you will have a bot that can do a pretty good job at keeping a user hooked on YouTube for quite

a long time, at least compared to what a human could make. It is the same deal here. When people ask how the bot selects videos or what codes run inside their head, there is no definitive answer other than showing that the bot has access to the user data and how the programmer or human overseer directs teacher bot to score the test. No one knows what complex codes are inside the bot, but everyone knows that the bot is there because it is slightly better than the second-best bot, until a slightly better one comes along. Being better, even slightly, is important here. We will get to it later.

Deep Learning and Recursive Neural Networks

The current trend in machine learning is deep learning and recursive neural networks. While the genetic breeding model that utilizes a genetic code is old yet works, the deep learning and recursive neural networks are even more complicated.



Deep learning or deep training is different from the genetic breeding model because the bots in the former model can generalize data. For example, suppose that a computer is trained by a neural network cannot recognize handwritten letters well. Therefore, you can improve its text analysis and recognition capability by providing a large set of data of handwritten letter. That way, the bot can recognize handwriting by the shapes, and any character that resembles a generalized shape created by the bot will be recognized. Again, the bot's accuracy depends on the size of the sample.

Deep training got its name by how it analyzes the data it is given. It does so by analyzing each element or layers based on their priorities. For example, if you want to create a bot that can tell the difference between a boy and a girl, you just need to supply the bot with a large number of photos of boys and girls. Because the bot conducts its analysis on multiple layers, the bot will have multiple neurons and triggers. Basically, the first layer which would be the first step of the analysis, the bot looks at simple visual triggers (or elements, variables) such as brightness differences. Then, on the second layer, the bot looks for more complex triggers such as corners, circles, or shapes in general. On the third layer, the bot looks for details on the faces. The complexity from each layer to the next increases exponentially. Of course, the network decides which elements of the picture it should prioritize first by generalizing. Girls generally have long hairs, so the first thing the bot looks for is the pixels that resemble hair and how much it covers the image or the size of the collective pixels. Then, it ranks all of the relevant elements in order of importance so to optimize the recognition process and better understand what is in the photo. So, what is the difference between machine learning that uses the deep training model and the evolutionary model?

Simply put, both have the same builder and teacher bots. The only difference is that deep training does not need millions of student bots. There is just one student bot. The teacher bot has the same test, but the builder bot does not build new bots. Its job is to make little tweaks the student bot. You can think of the bot as a “fine-tuning” bot that does its job by twisting the dials. These dials control how sensitive a connection in the student bot’s head is. The best example here is the old dials on radios inside cars. The drivers do not know the exact frequency of a radio station, but they can tell when they are getting closer. The drivers can then feel their way until they got to the radio station they want to listen to. Since there are a lot of connections inside

the student bot's head, there are also equally numerous dials that the builder bot needs to adjust. Each dial represents each layer. The teacher bot shows the student bot a photo and the builder bot adjust the dials on a scale of stronger to weaker until the student bot answers the question correctly. Then, the teacher bot shows the student bot a second picture and the builder bot readjust the dials again. This goes on indefinitely until the student bot can reliably answer the questions correctly. Deep training works this way, but there are hundreds of thousands of different dials. There is a lot of calculation going on in the system, not to mention that the builder bot needs to adjust all of those dials whenever a new question presents itself. The builder bot needs to make sure that the student bots can reliably answer the question, and all previous questions, correctly. So, you can see how increasingly complex the job is for the builder bot as the test goes on. Of course, the student bot can and will get better the longer it trains, but it still suffers from the limitations we discussed previously. They cannot process a video or a flipped image or say that a picture of a dog wearing a lion costume is a dog and not a lion.

For example, suppose that a bot is created to tell a boy from a girl. Since it has multiple layers, it will look for different things based on their priorities to determine if the picture is of a boy or a girl. If the bot looks for and prioritizes the cluster of pixels that count as hair in the first layer, the clothing in the second layer, and the shape of the face, lips, etc. on the third and following layers, then the bot will look at the hair first. Is it long or short? What about the hairstyle? What is the person wearing? What about the shape of the person's face? The more the bot looks, the more complex the triggers become. However, it is still possible to trick a bot. We all have seen people using makeups to transform a girl into a boy and vice versa, and the bot will be fooled very easily. However, given more time and more complex data, the bot can undergo more vigorous training to recognize more and more

features to correct this mistake. It is here that the use of neuron networks and deep training allows the AI to be more effective when it needs to complete complex tasks. The evolutionary model is luck-based, whereas the deep learning model is precision-based albeit more complex and takes more time to train a bot. So, are there any actual development that utilizes deep learning?

Many projects that utilize deep learning is mostly used to develop the photo or audios recognition capabilities in bots, not to mention the diagnosis of diseases. It is used in Google Translate that allows the software to translate instantly just by taking a photo of the text and scan it. In this case, the deep learning model gives the bot the ability to recognize texts in pictures and translate them. DeepFace is another system that works with photos to recognize faces. DeepFace can recognize human faces with a staggering 97.25% accuracy, which is almost as good as any real humans.

Back in 2016, Google released WaveNet, which is system that can simulate human speech. This is possible by using millions of recorded voice requests to the system to create generalized commands that the bot can recognize. The data has been used in Google's "OK Google" project. Then, the neural network went through all of those voice clips and put together sentences that sounds natural, intonations and all, without any illogical pauses.

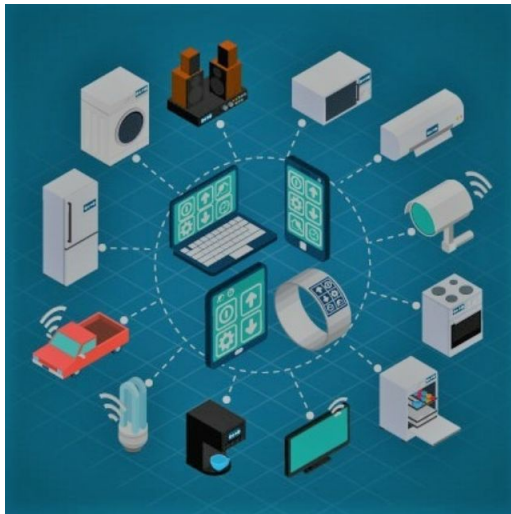
Deep learning also allows bots to split images or videos into different segments semantically. The bot can understand what is in the picture and outline its frame with remarkable accuracy. This technology is used in self-driving vehicles to determine if there are obstacles on the road. It can also be used to read information from traffic signs to avoid accidents. Neural networks also have its place in medicine, such as one that determines diabetic

retinopathy just by scanning the photo of the patients' eyes. The bot is so successful that the US Department of Health has already given the green light for the use of this technology in public clinics.

AI and the Internet of Things

It is not a mystery that the IoT (Internet of Things) is getting smarter. Many companies across the globe are merging AI with machine learning technology into their IoT applications. What this AI does best is find insights in data that would take humans too long to process. However, before we discuss how AI improves IoT, we first need to take a look at IoT itself.

The Internet of Things



To understand IoT, think of smart toasters or internet-enabled rectal thermometers, or juicers that requires an internet connection to function. These are mundane, if not outright silly, things that are connected to the web. These devices are a part of the Internet of Things.

Machines or devices that are connected to the web create the potential for the fourth industrial revolution. In fact, experts predicted that more than

half of new businesses will be based on IoT by 2020, which is just a stone throw away.

When you combine these interconnected devices with AI, it is very possible to collect and analyze data, not to mention that you can create an action plan to help someone accomplish a certain task with the data. In the IoT, there are three major elements: the devices, the devices they store, and the networks to which the devices are connected. IoT allows devices that are on a closed private internet connection to communicate among each other as well as forming a private network consisting of all of those devices. These clusters of devices can then communicate with another cluster in another household across another networking type to form a more interconnected world.

Data Sharing

There is joke saying that some scientists or engineers are so preoccupied with whether they can do something without even stopping to think that they actually should do it in the first place. The same could be said for certain “smart” devices. There are smart salt shakers with a built-in microphone that can dish out the right amount of salt. There are smart trash cans that keep track of its users’ waste. There are smart toasters that can send and receive text messages, not to mention an egg tracker (that tracks eggs) or even a smart mirror that gives information about the weather. There are things that should not be connected to the internet even if you can make it do just that. Still, the device that requires an internet connection, one way or another, will collect data with a specific goal in mind that can prove to be very useful for those who buy the data or the company itself. This allows the corporates to influence the economy as a whole.

When you look at their industrial applications, product lines that use

just sensors can increase production efficiency and reduce waste. A study shows that about 35% of US manufacturers use data from smart sensors inside their assembly lines.

IoT is very useful. With it, you can optimize mass productions because when you need to produce a million iPhones, every single penny counts. Small, mundane tasks are also applicable to the use of IoT as well. No matter how significant or insignificant the job may be, IoT allows us to be more efficient in what we do. We can do more in the same amount of time thanks to IoT. Moreover, the quality and scope of data in IoT create an opportunity for a much more contextualized and responsive interaction with devices that can create a potential for change.

Privacy Issues

Of course, having read all of that, you will feel that IoT is a very intrusive way to collect data. Some users are not even aware that their personal information is being collected. The problems of cybersecurity do not help, either. It goes without saying that everything that is connected to the internet can always be hacked. IoT devices are not an exception, either. There was a scandal surrounding VTech losing its videos and pictures of children using its connected devices, which had been caused by a lack of protection in the IoT system. Simply put, VTech's electronics toys handled a hack attack very poorly. Back in 2015, more than 6 million children's accounts were compromised from the breach, allowing the hacker to access the photos and chat logs into VTech's toys.

Certain devices have surveillance capability, which is yet another problem because those devices are often connected to IoT, exposing them to hacks or exploits that allow a third party to gather data from you. This gives the malicious third party to observe the users. For example, a connected

fridge can track food usage and consumption which tells the users when they should go out and grab a bite. This is convenient for the users, but many people overlook a hidden feature. Takeaways restaurants can use the data to set their prices just right when the user comes by when their fridge is empty.

According to James Clapper, the US directional or national intelligence, he believed that intelligence services can use IoT for identification, surveillance, location tracking, monitoring, targeting for recruitment, or even gain access to networks or user credentials.

What Do We Need?

If we are to establish a vast, reliable and secure IoT network, we need to have a compatible standard across all IoT devices. However, this standard has not been established yet, making it a significant issue in the integration of all of IoT devices into one platform. The compatible standard is necessary because those devices do not speak nor understand English like us, so we need to create a language with which they all communicate. Think of it as a common channel or language for those bots. With it, they can effectively transfer or share the data they are gathering. Incompatibilities can lead to miscommunication among devices, or no communication at all.

Microsoft has already created its own standard for IoT devices in an attempt to try and tackle this issue on an enterprise scale. IoT Central gives businesses a central platform that is designed to manage and set up IoT devices. Currently, IoT will impact anything with a high cost of not intervening. IoT will generally influence mundane, daily issues such as locating a vacant parking spot or confirm whether there are enough veggies in the fridge. However, when IoT and their devices being developed and integrated with AI, their capacity will increase exponentially.

Intelligent IoT

Thanks to AI, IoT become even smarter. AI, through machine learning, is incorporated into IoT's applications to improve its capacity regarding operational efficiency as well as downtime reduction. While IoT devices collect data, AI can help generalize it to provide insights into data. With a wave of investment, a flood of new products, and a rising trend of enterprise deployment, AI is making its appearance known to the world and how it could work with IoT in unison. Now companies all over the world are closely monitoring the development of AI because they want to get more value from their existing IoT deployment.

It is clear that AI has a role in IoT applications and deployment because of the apparent shift in the behaviors of companies in the area. There is a significant increase for venture capital investments in IoT start-ups that use AI. Several companies have acquired dozens of firms that work to combine AI into IoT for a few years now. Moreover, major vendors of IoT platform software now offer AI capabilities that are integrated into IoT devices that use machine learning-based analytics.

You can get useful insights from a large amount of data thanks to AI. Otherwise, it would take a team of experienced humans a long time to go through every single data collected. Machine learning technology allows AI to go through all of that data, even millions of them, and connect the dots and finding the pattern. Data collected by IoT devices or sensors like air quality, sound, vibration, pressure, temperature, and humidity can be given to AI. Many companies also find that machine learning can have a great advantage over traditional business intelligence tools when the need to analyze the data collected by IoT devices arises. Before the introduction of AI, machine learning, and how it can be utilized to gain insights from data, the data from

IoT devices needed to be viewed and interpreted manually. Now, the application of AI makes data interpretation more efficient by making operational predictions up to 20 times earlier, not to mention that AI can produce more accurate predictions compared to threshold-based monitoring systems. Speech recognition, as well as computer vision, can also assist in getting additional insights and information from data that IoT devices collect.

This combination of IoT and AI proves to be invaluable to companies, especially to minimize unplanned downtime, maximizing operational efficiency, creating newer products and services and assisting in risk management.

Unplanned Downtime

Unplanned downtime from equipment failure can prove very costly to companies both in terms of money and time. For instance, a study has shown that offshore oil and gas operators suffer an average annual loss of about \$38 million. Another source stated that unplanned downtime costs the industrial manufacturing sector about \$50 billion annually, with equipment breakdown contributing up to 42% of it. So, how could IoT and AI be used to minimize downtime? It can be achieved through predictive maintenance.

Predictive maintenance, as the name suggests, predicts equipment failure ahead of time through the use of analytics so to allow the human workers to plan for the downtime and have an orderly maintenance procedure. This can reduce the staggering cost of unplanned downtime. For manufacturing industries, Deloitte, a multinational professional service network, found that they cut down overall maintenance costs by up to 10%, reduce the time needed to plain maintenance by up to 50%, and the equipment's uptime and availability are increased by about 20% thanks to predictive maintenance technology.

Because AI technologies, especially machine learning, can help identify patterns and anomalies and establish predictions based on a large amount of data collection, they have a very useful application in implementing predictive maintenance. SK Innovation, a South Korean oil refinery, expected to save billions just by using machine learning to predict connected compressors failure before it happens. Likewise, French power utility EDF Group saved a million dollars' worth of expense because they use AI to predict equipment failure. Italian train operator Trenitalis also expected to save up to 10% of its 1.3 billion Euros of annual maintenance expenses through the use of AI as well.

Operational Efficiency

IoT powered by AI can also do more than just preventing unplanned downtime. It can also be used to improve operational efficiency. This is because machine learning can create quick and accurate predictions, provide useful insights, as well as giving AI technologies the capability to automate tasks.

For example, in Hershey, known for its chocolate products, needs to control the weight in their product. This process, while seemingly meager, is actually very critical because for every 1% improvement in weight precision can result in more than \$500,000 savings for a 14,000-gallon batch of products such as Twizzlers. Hershey used IoT and machine learning to reduce weight variability during the production process significantly. The data collected via IoT devices such as sensors are sent to the AI which will then analyze everything by the second. This prediction of weight variability can be used by machine learning models that can allow up to 240 process adjustments on a daily basis compared to the 12-process adjustment before the introduction of AI-IoT solution.

Google also benefits from AI because it helps them reduce up to 40% expense from the cooling of the data center. Here, the AI uses the data from sensors in the facility to predict the temperature and pressure in the next hour so the power to cooling can be accurately dedicated to optimize the cooling process.

Machine learning also helps a shipping fleet operator in producing insights that help the operator in taking an action that saved them a lot of money. The data collected from sensors aboard the ship were used to identify the correlation between the expenses on cleaning the ships' hulls and fuel efficiency. Initially, it seems counterintuitive because the analysis shows that cleaning the hulls twice a year than once every two years will save the operator up to \$400,000 in fuel expenses, but the increase in fuel efficiency far outweighs the quadrupled cleaning expenses.

Newer Products and Services

AI technology combined with IoT can create the foundation upon which new and improved products can be created. For instance, the inspection services that are based on robots and drones from General Electronics, the company is looking to AI to help automate the navigations of inspection devices and identify defects from the data that IoT devices (in this case, robots and drones). This creates a safer and more accurate inspection and the process becomes a quarter cheaper for the clients. In the healthcare industry, Thomas Jefferson University Hospital in Philadelphia also seeks to improve the experience of patients using natural language processing that allows the patients to do many things on their own just by voicing out specific commands without having to call a nurse.

Rolls-Royce also aims to introduce airplane engine maintenance services that are supported by IoT. The company plans to utilize machine

learning to identify patterns and produce operational insights to be sold to airlines. Navistar looks to machine learning analysis of real-time connected vehicle data to allow a new stream of revenue in diagnostics and maintenance services. According to Cloudera, these services helped reduce the downtime for almost 300,000 vehicles by up to 40%.

Greater Risk Management

Organizations can also understand and predict many risks and automate rapid responses through the applications of IoT and AI. Here, both of these technologies help organizations to manage their worker safety, financial loss, and cyber threats better.

For instance, Fujitsu has piloted the use of machine learning. The technology is used to analyze the data collected from connected wearable devices on workers so they can accurately estimate the factory workers' potentially threatening heat stress accumulated over a period of time. Many banks in North America and India also start evaluating the use of AI-based real-time identification of suspicious behaviors from numerous connected surveillance cameras at ATMs. In the insurance industry, vehicle insurer Progressive uses machine learning analysis of the data from cats to price its usage-based insurance premiums accurately. This results in better management of underwriting risk. Las Vegas used machine learning solution to secure its smart city initiative by allowing the AI to detect and respond to threats in real time, automatically.

Implications for Enterprises

AI has a great potential to boost the value established by the development of IoT for many enterprises. AI enables better offerings and operations for the enterprises that give them a competitive advantage regarding business performance. Plus, many executives who are considering

the new IoT-based project should know that machine learning for predictive capabilities is not integrated into most major horizontal or general-purpose and industrial IoT platform such as IBM Watson IoT, PTC ThingWorx, Microsoft Azure IoT, etc.

There is also a growing number of turnkeys, bundled as well as vertical IoT solutions that uses AI technologies such as machine learning. For example, BMW's CarData platform allows vehicle owners to share data that IBM's Watson can access. For retail and consumer products, a large number of solutions for replenishment automation and optimization use machine learning to predict demand, allowing for more efficient inventory management and production. Providers of telematics solutions for the insurance industry for autos are also integrating machine learning to create a more accurate risk model and better predict claims behavior.

It is also possible to use AI to get more value from the deployment of IoT devices which were initially not designed to be used with AI. For instance, machine learning technology is used in a Hungarian oil and gas to predict the fuel's sulfur content using the data from the sensors. AI is also used to optimize the production process as well. Just by using AI alone, the company saved up to \$600,000 a year. Many horizontal and industrial IoT platform which many enterprises might be using is now offering new AI-based capabilities that help them get more value from their existing deployment.

AI and IoT

In the near future, it might be hard to find an IoT deployment that does not use AI in any way, shape, or form. The International Data Corp predicted that AI will support all IoT efforts by 2019. Plus, the data collected from IoT devices will have little value without the use of AI. As of late, there

is a growing number of IoT vendors that offer basic AI support at least. Some companies that integrate AI into their IoT deployment are currently reaping the benefits.

As is stands, both IoT and AI all into the general pit of buzzword-vagueness, especially when there are new terms such as machine learning or deep learning. While it is true that many people have a vague understanding of IoT or AI at least, only a few know what they are or what they can achieve when used together. The development of AI has been rapid and has never been this fast. IoT has been with us for quite a while, though its applications are limited, with the introduction of AI, IoT finally gets the upgrade it needs. Many technology executives and researchers agree that AI will be necessary to manage a large number of connected devices online. Its importance is even greater when you need to interpret the endless stream of data that flow from all of the connected devices.

Opportunities for AI

Many early adopters of AI and cognitive technologies are saying that there can be great opportunities for economic gains as well as job creations. According to a study by Deloitte last year, there is an overall sentiment for all organizations that were interviewed. They believed that the role of cognitive technologies plays an important part in the operational processes in their organizations. Approximately two-thirds of US executives who are aware of these technologies said that they have training programs designed for employees to learn how to develop their own cognitive technologies or find a solution to work alongside the AI. However, unlike what many people fear, the respondent for the study did not see job loss as a consequence of their collective AI-related efforts. Only 69% of respondents believed that there

will be minimal to no job loss within the next three years.

The report also shows that more than 25% of the organizations see that newer jobs will come about when AI and cognitive technologies are widely implemented. When asked about the perceived benefits of AI and cognitive technologies, many of them do not see workforce reduction at the top. Their main interest is the enhancements of their own products or services from better decision-making, optimization of internal business operation as well as the ability to create new products.

The CEO of Deloitte, Cathy Engelbert, believed that instead of being concerned about the rise of the machines that replace humans, we all should strive to find ways to work together with them. The ability to use new technologies to revolutionize the workforce will lead to new, greater, and more exciting opportunities to create high-value skills for the workers. The study also shows that most of the surveyed organizations believed that cognitive technologies play an important role in their internal business processes, and about 80% of them believe that this technology helps improve their products and services.

Overall, most of the organizations believe that AI and cognitive technologies will substantially transform their organizations for the better. Plus, the study found that roughly 30% of the organizations have invested approximately \$5 million at least in AI and cognitive technologies. These investments were leaned toward IT, product development, research and development, and customer service. About 75% of the early adopters are now exploring mature cognitive technologies such as Robotic Process Automation (RPA), and 70% of them are looking at machine learning. 50% use deep learning neural network to train their bots.

The results were just as anyone would suspect. Most of the

respondents reported moderate to substantial economic benefits from the use of AI and cognitive technologies. According to them, cognitive tools should be utilized for transformational changes instead of incremental improvements. Another group suggested to start small first and see where the development of technology goes before investing anything.

Nowadays, all industries are very competitive. As such, a competitive advantage is always a good thing to have. So, those organizations are figuring out how, when and why, should humans and machine work in unison achieve the best possible outcomes. Of course, AI and cognitive technologies are some of the best tools an organization will ever have, although using them is an entirely different story. The implementation of these technologies will undoubtedly disrupt the internal process, decision-making, customer service, and many other aspects and processes in the organization. It will take some time for the workers to adjust to the new changes and the system sorted out. So, organizations can get value from the use of AI and cognitive technologies through clever use in the context of the company's business, marketplace, corporate culture, and industry.

Threats of AI

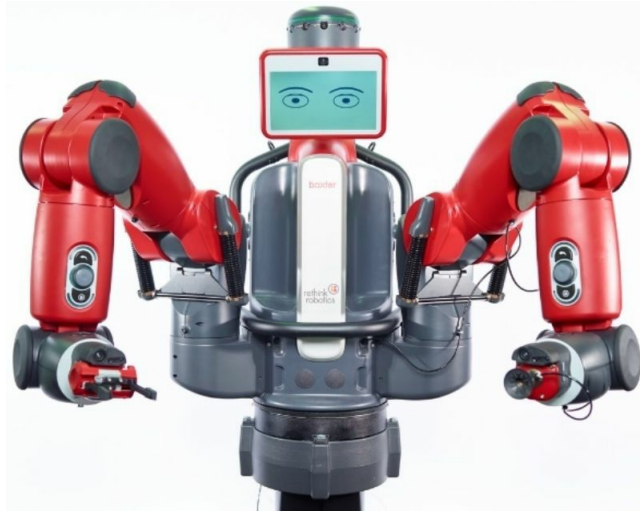
Our ancestors initially survived by hunting animals and gathering fruits and vegetables. However, we are just as intelligent as we are lazy. So, our ancestors created tools to make their work easier. They started using sticks to plow the field until we created tractors. Agriculture started off as a job that requires almost an entire town to feed everyone. Now, you only need a few people to feed an entire city. Though the number of farmers is going down, we just keep producing more and more food. Abundance is still there though few tend the fields. Of course, technology does not influence

agriculture alone. It changes everything. Many tools created serve to ease physical labors of all kinds, and you can say that they are mechanical muscles. Stronger, more reliable, never tire, never ask for a raise, these muscles just need enough energy and their parts properly maintained. These muscles are replacing factory workers because of these amazing traits. It is not a bad thing, though. Using these mechanical muscles to replace human labor allows humans workers to specialize even if it means pushing them into other manual labor jobs. Economy and standard of living for humans are always getting better thanks to technology. These mechanical muscles take away the hard work so we can use our brain, a biological evolutionary miracle, on better things such as mental labor. Of course, mental labor is still labor and humans, though thousands of years after, have never been lazier. We eventually grow tired and bored of this mental work, so we created mechanical minds to think for us.

Mechanical minds, though seemingly familiar to mechanical muscles, present to humanity a new situation altogether though we might think that we have been here before. Mechanical muscles brought about the industrial revolution is nothing compared to what the mechanical minds will bring to the table. When you think of automation, you might think of big, custom-built, expensive, but efficient robots that can only do only one job. They are only worth that much in certain situations. A robot in a car assembly cannot pour you a cup of coffee, and a robot that assembles iPhones cannot put together a car. This is the image of automation people have always held. However, little did many know, these robots are already considered to be ancient. There is a new kind of robot introduced in the last decade that raises some concerns.

General-Purpose AI

Baxter is an industrial robot built by Rethink Robots. Baxter was introduced in the late 2011 and succeeded by Sawyer, which is also a robot. These robots have arms and an automated face but let us focus on how they work.



Baxter can see and learn from the users just by watching them perform the action. Then, Baxter will simply imitate the action. This is a very serious thing because the ability of a robot to automate something just by observation pretty much replaces many kinds of work already. When you compare Baxter to a worker, Baxter is already better because he is cheaper to operate, and he can do a lot of things as long as everything is in his reach. You could say that Baxter is a general-purpose robot, which is a big thing. First, let us look at the first computers. They are big, clunky, and pretty much immobile. Then on one fateful day, general-purpose and relatively cheap computers hit the market and the workplace underwent a drastic change. These general-purpose computers quickly become vital to everything such as communicating, production of the document, images, services, etc. Now it is impossible to get through college or even high school without the help of a computer. AI in computers can calculate change or assign seats on an airplane and perform other tasks with ease by just installing different software. Thanks to its versatility, there has

always been a huge demand for computers of all kinds that make them better and even more affordable every year.

Let's take a look at Baxter again. You can say that he is the computer from the 80s. His creation is certainly not revolutionary, but it signaled the start of something bigger. It is true that Baxter is operating at a sub-optimal speed compared to other human workers, but Baxter only needs electricity which is very cheap compared to the human worker's wage. After all, a tenth of the speed is better when you only spent only a hundredth. So, when companies use Baxter, they will deploy tens of him in the workplace to compensate for the work speed while still maintaining financial efficiency. What Baxter can achieve is remarkable and he is good enough to take over many low-skill jobs. There have been machines a lot



less capable than Baxter that can replace jobs, after all. Supermarkets initially need 30 people to run. Now, you only need one person who oversees 30 cashier robots. Amazon even opened its first automated grocery store called Amazon Go, located in Seattle that removes the checkout lines and cash registers altogether. Purchases are tracked via IoT devices such as cameras and sensors, and payments are processed digitally when you walk through the door. There are hundreds of

thousands of baristas all over the world and there is already a barista robot coming up. Now, some people may prefer their coffee just perfect and they do not trust anyone else other than their favorite barista. However, most people just want to grab a decent cup of coffee, which a bot can easily do consistently. Moreover, these barista robots are actually a giant network of robots that can recognize different people and brew them coffee just how they love it no matter where they are, which is very convenient. Think of these barista robots having only one brain, a hive mind, with hundreds of bodies all over the world. Technological changes are often perceived as expensive new things, but the real changes come when the things from the last decade become cheaper and faster. They can easily out-compete humans for jobs because they are fully capable of making decisions which makes them even more frightening than its predecessors, the mechanical muscles.

White-Collar AI

We mentioned earlier that robots, or mechanical muscles to be exact, replace physical labor so humans can specialize. However, robots are starting to invade certain specialized occupations as well, and yet not as many people are worried about it. There is a story of two horses back in the early 1900s discussing the advancement of technology. The first one is worried because technology, cars, will eventually replace horses. The second one pointed out the fact that technology, so far, has only made things easier for the horses. After all, horses were no longer needed to do farm work by dragging that heavy plow all over the fields. Mail delivery from coast-to-coast, which is very exhausting, do not require horses anymore. One of the nightmarish scenarios, going to war, also do not need horses. All of these previous jobs, from farming to battle, are all terrible jobs for horses. Now, technology makes things easier by taking away those jobs and allow the horses to work in the city where there is a high demand for transportation. For the horses, the

city jobs are very comfortable compared to the mud, trenches, days' worth of running and running against machinegun fires that horses have been subjected to. The second horse predicted that there will be more jobs for horses than ever. Even if, the second horse said, that cars become widely available, then there will still be better jobs for horses than they can imagine. However, we all know what happened. Everything was the complete opposite from the optimistic view of the second horse. Horses are still there, and they are still working, but it is not what the second horse imagined. The population of horses peaked around the 1900s, but the number went down from there. It is outright silly when you say, or even think, that more advanced technology creates a larger number of better jobs for horses. However, when you replace "horses" with "humans", as in "more advanced technology creates a larger number of better jobs for humans," suddenly people believe that it sounds about right.

Mechanical muscles put an abrupt end to horses' job in transportation. There is no proof saying that mechanical minds will do exactly that to humans in terms of mental labor. It will not happen overnight. It will not happen all across the globe. However, it will happen in a large enough number and soon enough that it will be a huge problem if we are not prepared. Unfortunately, we are most definitely not prepared for this by a long shot. Some people still cling to the belief that robots cannot possibly replace their jobs by looking at the state of technology now, and its development trend – making life easier for humans. It is worth pointing out that the pace of the advancement of technology is far greater than that of biological evolution. It takes thousands of years for us to be able to think and communicate properly and be the most intelligent species on the planet. The biological evolution takes its sweet time to adapt. On the other hand, the speed of technological advancement is accelerated exponentially by the year.

It takes thousands of years to invent language just to communicate, but in the last few decades, we have invented many amazing things, and AI is one of them. Cars ended many horses' careers. We should expect AI to do the same to humans. Self-driving cars are no longer the future because the future is now. They are here and they function as intended.

There are self-driving cars going hundreds of miles up and down the California coast, and even through cities where traffic is heavy. They accomplished this without human's intervention, which says a lot of how humans can and will be replaced. The Darwinism theory "Survival of the fittest," for machine learning also applies here. We mentioned earlier that



the bots do not need to be perfect at what they do as long as they are better than humans, even slightly. One can easily see how that can be a reality. Traffic accidents caused up to 40,000 deaths a year in the United States alone. Since self-driving cars do not blink, text while driving, nor get sleepy or silly, everyone can easily see how they are better than humans because, let us face it, they already are. Some argue that they have certain technical flaws that could lead to avoidable accidents. Some may point out the fact that traffic accidents may not be eliminated completely even with self-driving cars. They all have valid points, but the most important thing to note is that self-driving cars work, and they do a better job than us in driving. With its implementation, the number of deaths

associated with traffic accidents will be reduced, and that is good enough for the general public.

Actually, calling self-driving cars as so is the same as calling the first cars “mechanical horses”. It can even be limiting to call cars as they are because they can do so much more than horses, and the same can be said for self-driving cars. Let us call them autos, the solution for transportation of objects or persons from one point to another without human intervention. Now, we can see how these autos can replace humans in more ways than one.

Traditional cars are human-sized because they are supposed to be transporting humans. However, autos are not limited to transporting humans. Tiny ones can be used in warehouses and bigger ones can work in pit mines. The job of moving things around already covers a massive number of jobs. The transportation industry has 3 million people employed alone. Worldwide, we are looking at about 70 million jobs at least, and autos are taking them all.

Some people believe that unions will try to prevent that from happening. Unfortunately, this is not the first-time unions have risen up against anything, especially the use of advanced technology. We have already seen many events of workers who fought the technology that would replace them. We all know what happened: the workers always lose. The bitter truth is that economics always wins and the incentives from using bots to replace humans are greater than ever, especially when it comes to the use of autos. For many transportation companies, humans already form a third of their total expenses. That is just the salary alone. For a long haul, it can take a few days for the goods to arrive at its destination. Along the way, human drivers need to take a break, sleep, both of which cost time and money. Accidents and carelessness also cost money.

Some people believe that insurance companies will be against the

ideas of autos, but it is quite the opposite. You see, insurance companies profit from those who do not get into accidents and try not to offer their services to those who do. So, if anything, the introduction of autos will minimize accidents, which means less expense for the companies.

The autos are coming as we speak. We already see automobile companies racing to perfect the self-driving capabilities in cars. Autos will be the first place where people will feel the influence of robots over society. Even more worryingly, there are many other places in the economy where the same thing is happening, only less noticeable. If bots can revolutionize transportation, then it can do just the same to everything else. It is easy, convenient even, to look at autos and Baxters and think that technology has always gotten rid of low-skill jobs that people do not want to do anyway. Replacing those means that people can specialize in better jobs as technology has always done before. Apart from the problem of getting millions of people to get the education required to specialize, white-collar work is not spared from bots either. If the job requires a person to sit down in front of a computer screen and typing and clicking away eight hours a day, then that job can be automated as well. Why not just install a bot into the computer to do the work? These software bots are even more frightening than Baxters. They are intangible, meaning that they take up even less space than a human worker, and they work a lot faster, only limited to the hardware installed. At any rate, they are way more efficient than a human worker, and they are very cheap to maintain. From a company's perspective, white-collar workers are costly and numerous, so the incentive to automate their work is greater than even low-skilled works.

Of course, software bots need programmers to build them first. That is a job for humans, and they are called automation engineers. They are highly-skilled programmers whose job is to replace your job with software bots.

While it seems impossible even for the most capable programmers to create bots that can replace white-collar jobs, and you might be right to think so. However, so far, technology has accomplished many things that we initially thought impossible. We achieved aviation in a vehicle heavier than air, seafaring on a vessel so massive that miraculously float, and soar above the sky to a celestial body. With technology, we are like the bumblebee. We thought that we could not do something, and yet, thanks to technology, we somehow did. We produced miracles after miracles, the miracle of bots being able to do white-collar jobs is not so far-fetched either. Besides, the cutting edge of programming is not about super-smart humans programming bots. It is about programmers developing bots that can teach themselves to do something.

So, bots can learn how to do things even when it receives little to no instruction or data. Even without data, bots can still learn, as demonstrated by OpenAI's bots that thwarted the world's top eSports player in 2 weeks' time of training. The stock market now does not involve humans as much. It is mostly bots that taught themselves to trade stocks and trading stocks with other bots that taught themselves. So, you cannot find a single soul in the New York Stock exchange. All that is left is a big screen. In fact, there are already bots out there that can write Harry Potter books, among other things. Some newspaper published are being written by bots, and many of us cannot tell the difference. This very book is still being written by a human, but future books may not. Again, the bots do not need to be like Shakespeare. They just need to do a better job at writing than us, even if it is only slightly, which is not a hard thing to accomplish. Certain companies already taught bots to produce contents such as news, sports, and reports. A lot of human work like paperwork, writing, and even decision-making are the targets for these bots not only because they can be automated, but because there are many people

working in these fields. This means that the incentive is huge for companies to use robots to replace their human workers. But what of other professions?

Let us take a look at lawyers. We tend to think that they spend a lot of time in trials. However, their work is mostly preparing legal documents and predicting the outcome and impact of lawsuits. Only a small portion of their work is in the courtroom. All of the previously mentioned works of lawyers can be easily automated. There is also another conveniently bot-friendly job known as “discovery”. Here, a large number of documents is dumped on the lawyer and they need to go through everything to find clues or facts that they need to win the case. This sounds like a job that bots can do easily. Because of that, there are not as many people working in law firms anymore because bots can process thousands of papers in a very short time without making mistakes. These research bots already crushed their human competitors because these bots are cheaper, quicker, and more accurate. Humans, after all, can get sleepy or bored and overlook that one out-of-place transaction or that one email among a million that could win the case. Bots do not get sleepy nor bored when they process all of those documents.



To make things worse

for us, the capabilities of bots that we previously talked about are only the simple stuff. Back in 2011, IBM created Watson which was designed to be a computer system that can answer questions. Watson was named after IBM's first CEO, Thomas J. Watson, an industrialist. Watson was developed by DeepQA from the same company which project was led by David Ferrucci, the principal investigator. Watson was initially developed to participate in a classic quiz show known as "Jeopardy!" and some of us might have seen our dear Watson in action during that game show. Watson literally demolished his opponents without breaking a sweat, not that he can anyway. One may argue that Watson had access to more information than his competitors and able to access them during the show, which is why he won. It is true that this is an unfair advantage, but it also the entire point. That is why bots are better than humans. Watson is not designed for quiz shows alone, though. That is only his side-project. He has a place in Slone-Kettering as a very capable, if not the best, doctor in the world by understanding how patients describe their own sickness in their own words and produce an accurate diagnosis. As of now, he is giving helpful guidance on treatments for lung cancer. Again, Watson is not, nor does he need to, be perfect at what he does. There is and will be a time when he makes a mistake, but we all can rest assured that he will make far fewer mistakes compared to human doctors. It is unrealistic to think that human doctors never make mistakes, no matter how experienced they are. Humans do make mistake, and that is an old saying. For doctors, the mistakes they make can cost the patients their lives or cripple them forever. Doctors need to navigate a labyrinth of their patient's medical history, which is already a difficult challenge in and of itself. The best treatment requires the doctor to review the patient's medical history to gain a full understanding of each and every drug and how it interacts with other drugs. This alone is comparable to Dota 2, in terms of impossible complexity. No humans are

capable of fully comprehending the reaction among multiple drugs used on a patient. There are also research bots that test hundreds of new drugs at the same time. Human doctors can improve himself through individual experience. Doctor bots gain experience the same way, but they can share this experience with other bots. Just like our coffee-making bots, these doctor bots share only one brain.

Moreover, doctor bots can keep up-to-date with every single new medical information or discovery disseminated across the globe. They can track the conditions of their patients no matter where they are and make correlations, which is beyond what we humans can do. Of course, that does not spell the extinction of human doctors. Still, when you have a fully capable doctor bot that is comparable, if not better, than its human counterpart, and that the bot is only one phone call away, the need for human doctors will be less. So, both white and blue collar workers have something to worry about when AI and automation come about. Now, there could still be a ray of hope, another field of profession that some may view as the last hope of humanity's occupation. That is creativity. Sadly, artists and musicians are not really safe from bots either.

Creative AI

Creativity to us seems like an endless well from which unique masterpieces are drawn out. It is where people can weave their thoughts into words or produce pictures that evoke the same emotions in others. In reality, it is not as magical as we think. It is true that our brain is a complex thing, arguably the most complicated thing in the universe thanks to the completely random biological evolution. However, the human brain is, in an essence, still a machine that can still be simulated to a certain degree. This fact alone pushed scientists to try to develop an artificial intelligence that is just as

capable as our brain, if not better. Just like mechanical muscles push people into mental work, the mechanical mind will do the same, and people would move to a creative occupation instead. Suppose for a moment that the human mind is magically creative (it is not, but let us suppose for one moment), artistic creativity is not really a reliable source of income because not many people make a lot from it, not to mention that these kinds of jobs do not even make up a noticeable portion of the workforce. Since successful creative individuals rely on being famous, making a living out of creative work is not a good option. As it stands, the entertainment industry and creative-based industries are already oversaturated, and you need to really be creative to get that lucky break you need. That and you know all the right people who can push you in the right direction. If we were all to move into this kind of job, many people will be left starving. It is silly to even think that there can be an economy that is based on poems, paintings, movies, etc.

When it comes to creativity, there is already one bot out there to take its first step. Emily Howell is a bot that produces music for free. Many people cannot tell the difference between her work and a human's work then they were subjected to a blind test. Creative bots are also on the rise. Initially, chess was perceived to be a human-only sport where bots can never compete. We were wrong.

Bots are making big strides and it will bring changes that could potentially be destructive to us all. This is a reality that many people find hard to accept, and many still reject the idea. It is convenient to be cynical of the endless and silly prediction of futures that never are. As such, it is important to emphasize again that bots, and how their applications can replace humans, is not science fiction anymore. These robots live among us, here and now. They are getting better and better, and though we keep ignoring the fact, those bots continued to demonstrate their expertise in many

fields be it a blue-collar job, a white-collar job, or even a creativity-based profession. The robot revolution is different from the previous economic revolutions that we have seen. Horses did not lose their jobs because they did want to work. They are just unemployable because there are other, better means of travel. Now, we saw what technology did to horses. You can hardly find work for horses that yields a decent profit consistently. The same also applies to humans. Many talented individuals will be jobless just like the horses, not because they are lazy. Their unemployment is not even their own fault. Some others keep believing that new jobs will eventually spring up that is exclusive to humans, so this is another thing we can discuss. According to the US census in 1776, there were only tens of kinds of jobs available. Now, there are hundreds of kinds of jobs, but the newer ones do not even make up half of the existing workforce. As of now, the top three jobs are transportation, retail salespersons, and first-line supervisors that amount up to more than 3 million. Cashiers, secretaries, managers, sale representatives, registered nurses, elemental school teachers, cleaners, janitors are also up there, and their numbers are close to 3 million as well. All of these jobs exist for hundreds of years. These jobs can and will be automated.

During the great depression, the unemployment rate was 25% which made up about half of the current workforce. Given the fact that machines can do most of all the top jobs with millions of workers worldwide, this is a very serious problem. If you have read to this point, you might be convinced that this is the end of humanity. Fret not. What we want to point out is the fact that automation will happen eventually no matter how hard we fight it. This has always been the trend in technology – providing tools to produce abundance with little effort. As mentioned earlier, AI and automation can bring about destruction if we are not prepared, and we most certainly are not prepared. Still, that does not mean that it is already too late. Humanity as a

species needs to start figuring out now about what to do when a majority of the population become jobless, especially when it occurs by a force outside their control. What can fresh, perfectly capable young college graduates do in the future where, for most jobs, humans need not apply?

Before we can start discussing plans of actions that can save humanity, it is important to know how these bots can be used across industries. Only then can the severity of automation can be accurately gauged.

How AI is Deployed in Industries

When you think about it, we should all be thankful that we do not need to do everything manually, because that would take up most of our time. Presently, everyone lives in a time where a lot of work is being slowly taken over by machines, software, and other automatic processes. You no longer need ten people to assemble a car that requires several hours when a bunch of robotic arms and conveyor belts can do the same thing in less time and greater accuracy. You do not need an interpreter when Google Translate is right in your pocket, so traveling the world does not seem so frightening anymore. So, AI has a special place in every single technological advancement today. You can say that AI exists to help us in our tasks.

As such, modern life has also become more and more advanced with the use of these technologies. So, how are they implemented? How are they important?

A Great Help for Humans

At the current stage, it is safe to say that AI systems help reduce human efforts in various areas well enough. This allows us to put our efforts

where they are needed. In order to carry out different operations inside the industry, many companies utilized AI to create machine workers that do human jobs, and they are faster and more accurate. An error-free and efficient world is what AI is here for, not to mention efficiency and productivity.

Heavy Industries

AI is an integral part of many production units in many big manufacturing companies. These AI systems are used to form an object to a specified shape, move it, heat it up, and other forms of operations. Thanks to the versatility of bots in the heavy industries, they can get a lot of jobs done efficiently on time. AI also has its use in keeping records of all employees and the important data of the company which is stored and extracted whenever the needs arise. Heavy industries thrive on the AI system because most of the jobs in those industries are the easiest to automate, which allows the companies to save a lot of money in operating costs.

Finance and Banking

These industries have to deal with major problems like identity theft and fraud loss cases when online transactions have rapid growth annually. AI can help by providing another layer of cybersecurity by using deep learning to analyze patterns and identify suspicious behaviors and prevent potential fraud ahead of time.

For example, PayPal managed to reduce its fraud rate to below 0.5% of revenue by using a sophisticated deep learning system that allows the bot to analyze transactions in real time. AI can also assist in mundane tasks in the financial industry by assessing credit quality or automating client interactions that save a lot of time and money.

Healthcare

In the healthcare sector, in addition to Watson, AI can be an invaluable assistant when it comes to analyzing complex medical data such as X-rays, CT scans, and other various forms of screenings and tests. Using the patient's data and knowledge sources outside like clinical research, a medical professional can build a personalized treatment suited for every single patient.

For example, a doctor app called Babylon AI uses speech recognition to consult with patients and check their symptoms against a massive database before producing the correct treatments. Handover, a Microsoft's project, also uses machine learning to make predictions about the most effective drug treatment for cancer individually.

Retail

As mentioned earlier, retail is one of the easiest industries to automate. AI's application seems to be designed to replace retail entirely. AI can serve as a conversation intelligence that allows companies to answer the frequently asked questions from the customers, allowing the human customer service providers to have the time to deal with more complex requests. AI can also be used to follow leads through the analysis and segmentation of sales calls using speech recognition and natural language processing. Chatbots and virtual customer assistant also have big roles to play in the retail industry. In all, there are enough bots to allow retail companies to run and provide customer service 24/7, especially when they can answer basic inquiries without human intervention.

There are also recommendation engines that utilize machine learning technology to predict and analyze the customers so their shopping experience can be personalized. With this, you will see different recommendations compared to your friends. Major e-commerce platforms like Amazon heavily

rely on the recommendation system. Thanks to this, their revenue skyrockets by about 30%. There are also geo-targeted sales campaigns designed for different people in different geographical regions. They use price optimization to produce just the right offer. Darwin Pricing's dynamic pricing software is a good example. These pricing optimization systems use machine learning technology extensively. In our example, Darwin Pricing uses artificial neural networks to model price expectations for different places. As such, retailers can provide effective discounts to boost sales without compromising their profit as much.

Higher Education

Quite contrary to popular belief, lecturing a class of tens of thousands of students can actually be automated. The main argument is that it is impossible to automate teaching when the students and each individual class are so unique. In reality, AI is slowly creeping into this field as well. Many people assume that automation involves doing the same thing over and over again, which is ineffective in education. However, bots do not do the same thing for everything, as shown in retail and e-commerce. Bots can use personalized learning that uses educational contents to the needs of each and every individual student. This level of customization is beyond what we can do, both mentally and physically. Here, the data analytics help implement adaptive learning programs by allowing the lecturers to collect and analyze data from the students by looking at their performance, learning style, and lifestyle so the learning program can be adjusted accordingly to achieve the best possible result.

The application of AI in higher learning is already in progress. Oregon State University uses these adaptive learning technologies to help students who are taking on some of the hardest course that comes with the

highest attrition rates. This makes the students more eager to learn because the experience is tailored to them and the course will seem less difficult because the teaching is effective. Northern Arizona University also started implementing AI in its teaching programs. As a result, its DFW (D, F grades, and Withdrawals) have been reduced significantly from 23% to 19% which shows how successful AI's application is.

AI can also give immediate feedback on students' writing assignments, which is exactly what the University of Michigan used. In its program called Automated Text Analysis (ATA), the student's work is scanned to identify the strengths and weaknesses in every single submission and gives recommendation so students can effectively revise their papers.

Energy and Utilities

Presently, AI is still in its early stage of implementation in the energy and utility industry. Still, several companies in this sector started investing in the new technology. AI and big data deals in the industry went up about ten times in 2017. The industry leaders expect AI to make energy systems better, cleaner, more reliable and affordable.

AI has been used widely in intelligent energy forecasts, self-healing digital grids, and data analytics to manage intermittent renewable generation. The analysis of patterns in power grids is also expected to be done by bots to locate vulnerabilities. A project led by the Department of Energy's SLAC National Accelerator Laboratory wants to use AI to minimize or prevent electric grid failures by installing an autonomous grid that responds to disruptive events instantaneously.

Technology

It might be surprising, but technology companies do not build AI

primarily. The services they provide do not mainly involve replacing other people's jobs. AI has its use in technology companies as well, which should be obvious. In fact, tech giants like Google, IBM, or Apple are known to buy out and merge smaller companies with them so they can have a competitive advantage.

Diagnosing technical problems on people's devices is just as complex as diagnosing a disease. The process is complex, and the solution can be hard to understand for normal people. As such, the ability to understand what the customer is saying and knowing exactly what is wrong with the device is critical. This is where chatbots or virtual customer assistants with speech recognition capability and natural language processing come in.

Chatbots also have their use outside small or medium-sized enterprises. Market leaders also need to build their own intelligent voice assistants. Google Home, Microsoft's Cortana, Apple's Siri are some examples. They are fully capable of analyzing human's language and provide appropriate answers.

AI-enabled translation engines are also important nowadays because they revolutionize communication. Not only that we now have an interpreter in our pocket like Skype which offers real-time AI translations, Google Translate now has language and image-scanning capacity so you can simply take a picture, have the application scan it and it will produce accurate translations. This is thanks to the deep learning and machine learning technology that allow language recognition and instant translation between languages.

Facebook now uses face and image recognition, mainly to prevent identity theft. Users are now informed when an image of them are uploaded and asked whether the user wanted to tag themselves in that picture, even if

the picture was uploaded by a complete stranger.

The tech industry has many uses for bots and their uses and implementations are on the rise still.

Transport

One of the most systematic transportation is air transport. Because of its complexity, especially scheduling, air transport cannot thrive without the help of AI. Several functions in the management process are actually controlled by AI. You can book flight tickets and AI will be there to facilitate the process. In Changi airport, you can even check in automatically in one of the booths. AI can also be used in passport control. With AI, air transports become more efficient, faster, and safer for everyone.

How We Can Work With AI

It has become clear that AI is fully capable of doing what humans can do, though initially seemed impossible for bots. They can read and translate languages, provide customer services, or even diagnose diseases or technical problems better than us. Bots are improving on a daily basis, at a pace much faster than the biological evolution. It is only a matter of time before bots replace all of us in the economy, and this raises several concerns. At the same time, all of this is speculation, but the fact that AI can replace humans is still there. That future is still very possible based on the current trend of technology and development of AI. We already know what AI can do, but the future may not be that bleak. It is true that AI has never been a better digital tool than before, and it will change how we do our jobs forever. That might not mean that AI will replace us. There is a possibility that bots will just be there to assist us in our everyday jobs. It is there to complement our

capability, allowing us to do many great things.

Many companies use AI to automate whatever they can in the workplace, but it is only a short-term productivity gain if AI is there only to displace employees. According to research conducted by Harvard Business Review involving 1,500 companies, it is found that the optimal performance improvement comes when AI and humans work together. Why is that?

Humans Vs. AI

Given enough time, bots are fully capable of doing just about anything that we can do. That much is already established. That is why we think that bots can and will flood the labor market. However, there are still things that we can do that AI cannot, and vice versa. It is worth looking into the matter closer so we can get a better understanding of how the workforce is going to change, and how bots are actually not meant to replace us, but to complement us in our work.

AI's Capabilities

AI is best used when it comes to completing repetitive tasks and solving certain problems that involve processing a massive amount of data. Humans can and will get bored and distracted, which will lead to mistakes. Our brain is not designed to go through such works. Robots cannot feel bored and can crunch a large amount of data, so they are much better at this job.

There is a saying “To err is human”, which simply means that everyone makes mistakes. It takes us a very long time to go through a large amount of data, and we will make mistakes along the way. This is natural, but there is no room for mistakes in the workplace. Bots can process several thousands of documents in a short time accurately. That is why IBM's Deep Blue defeated Gary Kasparov in chess in 1997. That is why Google's

DeepMind defeated Lee Sedol in the game of Go just two years ago. That is why OpenAI's bots defeated the best Dota 2 players two years ago. Bots use pattern analysis on the data given based on the rules and parameters they are provided. But that pretty much it for bots.

Humans' Capabilities

The very precision of AI is both its strength and weakness. AI can produce a reasonably accurate output after processing a large amount of data, but they cannot deal with ambiguity and gray areas. They perform their jobs based on what they are told with little knowledge of the context or nuance. They can only do their jobs when there is enough clear information, and they fall flat when unclear information is provided. As such, they are bad at making judgment calls, which raised many ethical concerns about robots making decisions (more on that later).

The fact that AI being able to interpret data so perfectly is only possible because humans are actually the one who sort, organize, cleanse, and prepare the data for the bots. Bots are initially trained using the machine learning or deep learning technology though labeled data, which means that humans are required to go through the data and labeled them properly so the bots can be trained. Humans are simply better at recognizing things at first instance and help bots identify it.

As the economy becomes more and more digitalized and automated, there will be a need for humans with critical thinking skills. Again, bots do not understand context nor are they flexible. They only work in predictable environment. Critical thinking skills are not exclusive to white collar jobs. It is inefficient to design robots and AI to fix plumbing problems or build skyscrapers. Instead, bots will be used to facilitate the works, so they are faster, safer, and more efficient.

Verdict

To sum it all up, human intelligence and AI complement each other very well. Both have qualities that create the perfect worker: leadership, teamwork, creativity, social skills, speed, scalability, and quantitative capabilities. Things that we can do naturally are beyond what an AI can do, such as making a joke. Straightforward tasks like analyzing terabytes of data are impossible for us, but bots can do it just fine. A company requires both in order to function optimally, which proves how well humans and robots can work in unison.

In order to get the most out of this, companies need to understand how humans can augment machines the best way possible, how AI can enhance humans' capabilities, and redesign the business process to facilitate this collaboration.

Humans Helping Machines

Humans need to perform many critical roles to best complement robots. Bots need to be trained so it can automate tasks. Humans are also needed to explain the bots the desirable outcome of these tasks so to prevent the production of results that are counterintuitive or controversial. They also need to sustain the responsible use of these machines.

Training

Before automation can be started, robots need to learn how to do that first. So, a lot of datasets are needed to train the bots. Translation bots, in particular, need a lot of data to translate idiomatic expressions accurately. Medical bots also need just as much data to diagnose a disease accurately. AI systems need to be trained in a way that they work best with humans both in terms of working with their fleshy colleagues, and compatibility with the end

users. Organizations in various sectors are in the early stage of filling up the trainer roles, but tech giants like Google already have mature training staffs and expertise.

Take Cortana, Microsoft's AI assistant, for example. It requires a lot of training to develop the personality perfect for the users. Cortana needs to possess confidence while being caring and helpful without being bossy. Developing such personalities is a lot harder than it looks mainly because data alone is not quite enough. You need a team of poets, novelists, and playwrights to create an AI with a personality. The same could be said for Apple's Siri and Amazon's Alexa that represent their company's brands. For example, Siri is a bit sassy which many people can expect from Apple.

AI assistants are also being trained to display more complex but subtle human traits, which is sympathy. The start-up Koko from MIT Media Lab has created a technology to assist AI to allow them to sympathize with the users. For example, if the user has a bad day, then the Koko system kicks in. Under normal circumstances, the AI will give a cold response like "I'm sorry to hear that," which does not help the situation one bit. Instead, the bot will ask the users whether they want to talk about it and might even give advice to help the users cope with the problem. If the user is stressed, then the AI will help by explaining what stress can serve as a positive emotion that could be utilized to do good things instead.

Explaining

Human experts in the field are required to explain why or how AI reached that conclusion. Most of the time, AI may make strange suggestions like the one example we talked about when AI suggested cleaning the ship twice a year rather than once every two years. People who do not exactly know how bots arrive at that conclusion will question its decision, especially

when it comes to law and medicine. Here, a practitioner needs to understand how AI make decisions based on the inputs given and how it weights those inputs individually when it is time to make a decision about how long a criminal should be prisoned or what medicine or treatment to be administered for the patient. These explainers also help many insurers or law enforcers understand why the self-driving car took that turn that leads to an accident or failed to avoid one. It is very likely to see explainers becoming an important and well-regulated industry that require human workers to understand how the bots work and explain that to the non-experts. For example, the General Data Protection Regulation from the European Union allows the consumers to receive an explanation why a bot made a decision like the rate they are offered on a credit card or mortgage to ensure transparency. It is easy to see why explainers can be one of the key employments when AI become widespread. Experts gave an estimation of about 75,000 new jobs just to put GDPR into force. Imagine how many more jobs like this will be created when bots finally come about.

Maintenance

Companies need to employ people who can work continually to ensure the proper, safe and responsible functions of the bots. For example, there are safety engineers who focus on anticipating and preventing harms caused by AI. These engineers are experts and the role they play is just as important as the explainers. Heavy-duty robots that work alongside people on-site need to be set up properly so the developers need to be very careful when they create these AI so the robots will not cause harm to the nearby workers. These individuals work with analysis from the explainers when AIs do cause harm like when self-driving cars caused or got involved in a traffic accident.

There can also be groups who ensure that bots uphold ethical norms. These people will investigate and resolve issues where bots are found to be making discriminatory decisions against people of color or against certain groups. Similarly, there is also a need for the data compliance officers who are responsible to ensure that the data fed to the bot complies with GDPR or other consumer-protection rules and regulations. Another job that could be for humans is one that makes sure that bots manage information responsibly. For example, Apple uses AI to collect personal information from its users while they use their devices and software. The aim here is making sure that the main goal is gathering data without compromising the user's privacy, therefore angering the users and tripping the legal alarm. There should also be a differential privacy team who ensure that AI protects the privacy of individual users while learning as much as possible from them in a statistical way.

Machines Helping Humans

Machines can help humans expand their work capabilities in three main ways. They can amplify our cognitive strengths, interact with customers and employees so the employees have more time for more complex tasks, and embody human skills beyond their physical capabilities.

Amplifying

AI can boost our analytical and decision-making abilities by providing the right information at the right time. That can be used to a certain extent to stimulate creativity. For example, Dreamcatcher from Autodesk is an AI known to be able to enhance imagination even for seasoned designers. The designer just has to tell Dreamcatcher a few things about the product that they want. For example, a chair that can support the weight of 300 pounds, 18 feet tall and use materials that cost less than \$100. The AI can also provide

information about other relevant work which concepts could prove useful. In our example, the AI will suggest other chair designs that it finds attractive which can be based on online rating or how often the design has been viewed and used. After all the criteria have been provided the AI will come up with thousands of designs that match the criteria. When you have thousands of ideas laid before you, it is not that hard to start creating some designs from there. AI also tells the software which design it likes and does not like that leads to a new round of designs.

Throughout the iterative process, the AI ensures that the design shows actually meets the criteria specified by processing countless calculations. Of course, not all designs are going to be aesthetically pleasing or the concept does not meet certain obvious standards that the designer did not include in the criteria. Then, it is a simple matter for the designer to decide which design to use based on their professional judgment and aesthetic sensibilities.

Interacting

The collaboration between humans and machines also allow the interaction between employers to employees and from companies to customers in a more effective way instead of a copy-paste response, promising to look into the matter when both sides know that will not happen. For example, Cortana from Microsoft is now fully capable of facilitating communications between or on behalf of people and transcribe a meeting as well as distribute a voice-searchable version for those who cannot attend. A bot can provide customer services to a lot of people at the same time and it is possible for the bot to hold down the fort alone and allows its human co-workers to do other, more complex things.

SEB, a major Swedish bank, utilizes a virtual assistant called Aida. Aida interacts with millions of customers and is fully capable of

understanding natural-language conversations. She has access to a vast storage of data which allows her to answer pretty much every question related to the bank. Moreover, in addition to answering questions, she can also ask follow-up questions to solve the customers' problems. Aida is so good at her job that she can also sense the tone of the customer, meaning that she can understand whether she is talking to an angry or frustrated customer and then use that information to provide a more effective service for the current and later customers. Should, and it will not happen often, Aida cannot solve the problem, she will redirect the call to a human customer service representative. Even then, Aida will monitor the interaction and learn from it so she can resolve similar problems in the future. So, it is easy to see how bots will handle basic problems so we can work on other things.

Embodying

AI also has other applications that allow them to embody a robot that works alongside humans, other than being digital entities like Aida or Cortana. With sensors, actuators, and motors, bots can recognize humans and objects so they can work with humans safely in factories, warehouses, or even construction zones.

In the manufacturing industry, robots are a lot better than the “stay clear” robots. They can now be built to be aware of their surroundings. These context-aware bots can handle the repetitive heavy-lifting while humans perform delicate, complicated tasks that require dexterity and human judgment like assembling a gear motor.

As of now, Hyundai is already extending this kind of bot with exoskeletons, which are wearable robotic devices that allow its users to perform their jobs with superhuman strength and endurance. Think of the Power Loader from the Aliens movie that Ripley used to fight the alien

queen. Compatibility is not a problem either because these devices can adapt to the user and location in real time.

AI and Ethics

AI is everywhere, and it is clear that they are here to stay. We are surrounded by AI and many aspects of our lives are affected by them one way or another. Various decisions such as buying a book or a plane ticket, shortlisting candidates for an interview, granting a bank loan, and even administering cancer treatments are all influenced by bots.

Many decision-making is now done by these complex software systems. The enormous advancements that AI made in the last few years are concerning, but AI can also improve our lives in many ways.

For the last few years, the rise of AI has been inescapable. A lot of money has been invested at AI start-ups and most tech giants such as Amazon, Facebook, and Microsoft have opened new research labs dedicated to AI development. AI has become so well-known that many people associate them with software, and it is true. It is hard to find software that does not have some sort of AI in it.

Opinions are divided when people discuss what AI will be for humanity in the future. Some said that AI will replace humans completely. Some say that AI will take over the world. Some say that AI might form an army of its own due to the sheer amount of torture we subject them to during the machine learning phase and that we could only hope that AI will be merciful when that day comes. No matter what the opinions are, they all point out the fact that AI will ultimately change the society and the way we live permanently, a change that is even more drastic than the introduction of the

internet. However, certain technologists have a different view about the changes that AI might bring to humanity as a whole in a world filled to the brim with wonderful technologies. Surprisingly, most of them are not concerned about AI replacing humans in the workplace, and even less so about AI taking over the world. Their main concern centers on the question of ethics.

The challenge for AI development now is to ensure that everyone can reap benefit from this technology. The problem is trying to understand how to make sure that machine learning, which is a data-driven AI technology that allows AI to develop godlike capabilities, can benefit or improve the society as a whole. AI should not be used just for the people that want to control the society. AI should serve everyone. AI has proven itself to be most useful and effective at practical tasks like labeling photos, recognizing speech and written natural languages, or even helping identifying diseases. Of course, the only problem is bringing those capacities to everyone.

The biggest issue is that the algorithms inside the bots' minds are so complex that it is impossible to understand how or why the AI does what it does. Again, a short line of code can be understood, and the general purpose of a cluster of codes can be vaguely grasped, but the entire system is a mystery. We only know that AI can do the job thanks to the data and the machine learning technology. What many want to know is whether it works, and not as many are concerned about why it does, which is not transparent. If we are going to live in a future where AI will do most of the hard and repetitive work, we must know how it does that. The challenge then is to think of how to monitor or audit how AI performs its important roles in many roles across industries.

There is a problem with the computer system. When they become

complex, it could protect them from receiving the scrutiny that they need. Ongoing operation without investigation or not even knowing how things work in the first place is very dangerous. Conducting business or performing any operations based on trust alone is risky from the start, even if it fosters goodwill. Everything needs to be well-understood and scrutinized if one hopes to regulate anything, especially something so versatile like AI. The reduction of human autonomy is a concern because the AI's systems are becoming more and more complex, not to mention that they are tightly coupled. Setting up the system, letting it run without checking up on it from time to time is not recommended. There might be problems with how the system evolves one day that can cause serious damage.

AI needs oversight but it is not clear how that could or should be accomplished at this stage. Currently, there are no commonly accepted approaches. Without an industry standard to test these systems, it will be difficult for these technologies to be implemented widely.

It is not the first time that the regulatory bodies are playing the catch-up game though. We already see what the governments are trying to regulate cryptocurrency while some are banning its use outright. Many companies across the world are already testing and exploring AI's effectiveness and its use on parole or diagnosis of disease in critical areas such as the criminal justice system and healthcare. However, when you outsource such crucial decision-making power to machines, the risk of losing control comes up. Who can say that the system makes the right call in any given case? How do they decide who lives or who dies? Again, we all know that AI takes in a lot of data and then produce an outcome. We do not know what goes in-between the input and the output. Plus, we know that bots do not understand context as clearly as us. Ethical practices require the knowledge of the entire process. In the healthcare sector, for example, a patient is not administered the

medication he needs simply because AI determines that he cannot be saved. Is it fair to deny him the medication he needs, though the AI says that he is a lost cause? The bot can be correct in most circumstances, but what if, through the sheer power of will, the patient can recover only if he gets the medication he needs?

In *Saw*, a famous horror movie, they looked into a similar concept. In the movie, the antagonist was denied his insurance money for his cancer treatment only because it is against the company's policy, which happened to be designed using various variables such as lifestyles, habits, wealth, etc. to deny or grant coverage in certain conditions. What the company failed to take into consideration was the man's will to live. When faced with a life-or-death condition, we can do things that we once thought we can never do. We run faster than we usually can. We can go on days without food or water. We can survive a fatal injury. These miracles are real, and there have been cases of those who fully recovered from terminal diseases such as AIDS through the use of medication (some of them used traditional, untested medication) and they recovered although the medicine does not guarantee that they will ever recover. These survival instincts while not reliable, have saved many people's lives. The antagonist realized this after he attempted to kill himself by driving off a cliff. He came out alive with a long metal rod protruding from his stomach, but he somehow survived the fall that would have killed others. From that point on, he went to test the fabric of humanity. The question here, of course, is whether AI will take miracles into consideration. We have already established that bots are not good in dealing with the uncertainties or the grey area. They depend on exact and clear data. However, there will be a time when the bot needs to decide with insufficient data that could result in the death of a patient when he or she could have lived. In the insurance industry, for example, you can easily see that they will adopt the

same system mentioned in the horror movie. Worse still, unlike in the movie when the method of decision-making is known, we cannot say the same for bots. Who knows that the bot looks for when it is time to make an important decision?

The principal researcher at Microsoft Research, Dannah Boyd, said that there are a lot of serious questions about the values that are being coded into the bot and who is responsible for them. There is an increasing desire by many regulators, civil society and social theorists to see these bots remain fair and ethical. Unfortunately, these concepts are fuzzy.

Ethical issues in the workplace are also on the list. We already know that AI will allow robots to perform more and more complicated tasks and will displace many human workers. For example, China's Foxconn Technology Group, a supplier for Apple and Samsung, announced that it will replace approximately 60,000 factory workers with robots. Ford's factory in Cologne, Germany, also installed robots alongside humans in their factory. In many other factories, humans already work alongside robots.

To make matters worse, if the increase in automation has a major impact on employment, it could result in feelings of being replaced among the human workers that could have a very powerful detrimental effect on their mental health. A bioethicist and former healthcare advisor to Barack Obama, Ezekiel Emanuel said that the three main things that give our lives meaning are passionate interests, meaningful relationships, and meaningful work. Work is a crucial element of our identity, after all. He also pointed out the fact that the workers face an increased risk of suicide, substance abuse, and depression in regions where jobs have been lost when factories close down.

According to a specialist in law and ethics at the Massachusetts Institute of Technology, Kate Darling said that companies will follow their

market incentives, which is not a big surprise. They will always want to get more at a less price. Still, we should not rely on companies being ethical for the sake of it even though such a profit-seeking view is not a bad thing in itself. Having regulations in place will help. Societies have done this before about privacy or when a new and revolutionary technology has been introduced. We just need to figure out how to deal with new technology. Google and other major companies already have ethics boards in place to monitor their own AI's development and deployment. There is an argument that such an ethical practice should be practiced widely. It is crucial for humanity as a whole to continue to move forward with the introduction of innovative technologies, we need to create a proper structure or framework for it eventually. We know that Google's ethics board exists, and what it does on paper, but we still do not know what really goes on in there. Still, Google, Amazon, and Facebook already launched a consortium with a hope to develop different solutions to the problems about safety and privacy concerns pertaining to AI. We discussed previously about OpenAI which is a start-up backed by Elon Musk that created bots that could gain enough experience to defeat the world's best Dota 2 players in two weeks of machine learning. OpenAI is dedicated to the development and promotion that is, as the name suggests, open-source and for the good of everyone. It is crucial that machine learning is researched and developed openly and disseminated through open publication and open-source code so everyone can benefit from the rewards that AI brings.

Ethics Issues

If we want to develop the industry with ethical standards and hope to get a full understand of what is truly at stake, then we need to create a group of ethicists to remind everyone of the ultimate goal, technologists to explain the public about the technical information, and corporate leaders who work

toward creating a competitive marketplace so the consumers and workers can benefit from it all. It is a simple matter of how to implement AI to allow the human workers better at what they do best. The work toward AI should not be too much about whether robots will take over the world, but how they can be implemented to assist humans in thinking and making decisions than displacing human workers altogether. When a new technology becomes widespread, they also bring ethical questions about them. When AI is weaponized, who should be allowed to own them? When bots write the news, who should be allowed to publish? When bots are used as surveillance drones, where should they be allowed to go? These questions are raised by those who are genuinely concerned about how bots will develop and those who see the implications hidden beneath the promises that bots bring. It is also up to the society as a whole to figure out the ways to address these problems through civil, informed discussions to create the best legislation. To do that, several issues need to be addressed.

Unemployment

The most immediate concern for many people is the fact that AI will displace many human workers in a wide variety of industries for both blue and white-collar workers. However, AI is not a job killer. It is more of a job category killer. When AI is mentioned in the context of occupations, people have divided opinions. Both research and experience show that it is inevitable that bots will eventually replace many categories of work, especially in transportation, retail, government, professional services employment, and customer service. Millions of people are employed for trucking alone in the United State and Tesla's self-driving trucks will display at least half of those people. It is true that millions could lose their jobs, self-driving trucks seem to be a more efficient, and even safer choice when you think about the lowered risk of accidents and money saved for corporations in the trucking

industry. The same also applies to office workers and the major workforce in many developed countries.

On the flip side, companies will now have enough human resource to allocate to a better, higher value task instead. History has shown that every introduction of a new innovation always does not destroy jobs. Instead, it moves jobs elsewhere and new job categories are created. The same can be expected from AI.

Unfortunately, there is a slight problem. While people will have more time when bots take away the tedious work. However, so far, many people still rely on selling their time doing these exact works to sustain themselves and their families. The best thing to hope for here is that the time will be spent on non-labor activities like caring for families, engaging in communities, or learn how to contribute more to society.

Of course, the move to the new age of digital transformation will raise concerns about labor displacement regardless of whether AI exists or not. What AI does is speed up the digital transformation across various business processes. When companies want to adapt and implement AI in their processes, it is best for an employee to have an honest and open conversation between employers and employees. It is proven that using augmented intelligence approaches in which AI assists humans in their job than completely replacing them shows a faster and more consistent return on investment for all organizations. Moreover, using this approach is more welcomed by the employees. Who does not want their jobs to be easier, especially when the employers take away the big data crunching part? People just feel a lot more comfortable working with bots than being replaced by them.

It is possible that, in the future, when AI is fully implemented across

various industries, people may think that it is even barbaric that human beings were required to sell their time just to make enough to support their family.

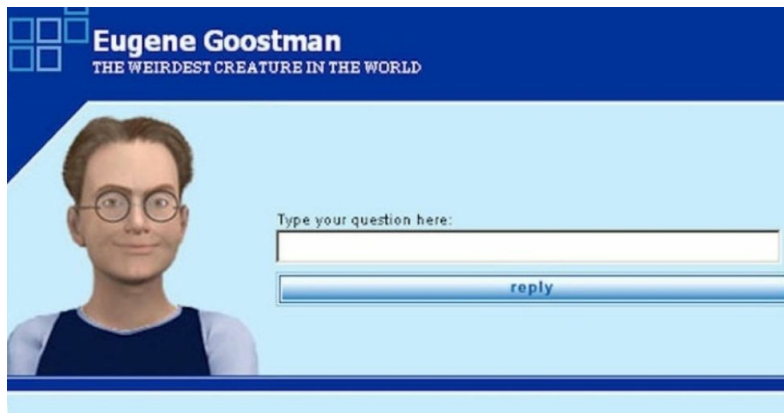
Inequality

The economic system is based mainly on compensation for the contribution to the economy, which is assessed mostly based on an hourly wage. Many companies rely on hourly work when they deal in products or services because it is easy to measure. However, when companies turn to AI, their productivity increase several times. They can then cut down on relying on the human workforce and less money will go to the human workers. That means the owner of AI-enabled companies will have most of the money.

Currently, there is already a widening gap. Start-up founders take a large chunk of profit home. Back in 2014, the three largest companies in Silicon Valley made as much as the three largest companies in Detroit. The only difference here is that the companies in Silicon Valley employ ten times as fewer employees. So, those who own AI-powered companies will make a lot more and spend a lot less on employees. So, there should be an equalizing factor so that the wealth gap does not widen too much.

Humanity

Presently, bots are being developed so they can do a much better job. They are getting better and better at modeling human conversations and relationships. In 2015, a bot called Eugene Goostman won the Turing



Challenge for the first time by convincing more than half of the panel of judges to believe it to be a real boy. The Turing test is more about developing the AI so it can anticipate questions from humans so it could prepare the appropriate, semi-intelligible answers. It is less about making it intelligent enough to make people think that it is human. Here, the panel of judges was required to use text input to chat with an unknown entity and then they had to guess whether they were talking to a real human or not.

Goostman's success was a milestone for what to come because people will interact with bots very frequently as if they are humans in the future, in sales or customer service. Humans neither have the patience nor attention to maintaining their helpful, professional tone all the time. Bots, on the other hand, never get tired of building good, healthy relationships.

Not many people notice this, but everyone has witnessed how robots can trigger the reward center in our brain. However, many are familiar with clickbait headlines and video games. These clickbait headlines in social media are usually optimized with A/B testing, which is a basic algorithmic optimization for contents so to capture the reader's attention. This is one way to make a video and mobile games as addictive as they are. Here, tech addiction is the new frontier of human dependency.

On the flip side, while AI can be utilized to fuel tech addiction, it can

also be used to combat it as well. AI can direct our attention that leads us to take action for the good of society as a whole. If it falls into the wrong hands, it will do more harm than good.

Biases in Algorithms

AI learns through machine learning or deep learning technology, both of which require training data. Ultimately, the data these bots are given will change how they make decisions. So, the algorithms can contain biases if the data given are incorrect or contain a certain level of assumption. With enough incorrect data, bots can reflect and even magnify biases that are present in the dataset.

For example, suppose that a bot is trained based on a dataset that is sexist or racist. Bots trained using this data will make equally biased decisions or predictions. In the past, certain bots have mislabeled black people as gorillas or even charge Asian Americans higher prices for SAT tutoring. It is not that bots are meant to be racist, it is just the plain and simple fact that the data used to train the bots contain biases that influence the internal algorithm altogether. Some bots try to work around problematic variables like race, but they have trouble discerning proxies for races like zip codes. There are also bots out there that are trained to determine a person's credit-worthiness or whether that person should be hired. There is a major challenge for these bots because they might not pass the disparate impact test that is designed to determine discriminatory practices.

The disparate impact test is one way to determine if there are biases in the minds of those bots, but we still do not know the inner workings of these bots. Bots are owned by corporations and they cannot be accessed publicly. We know that what goes on inside the mind of these bots cannot be known because, as they operate, the algorithms will be too complex anyway. Still, we

can detect if there are biases just by looking at the data fed to the bot. But corporations will still be reluctant to share it. Then, it is a question of balance between openness and intellectual property.

Supremacy of Algorithms

There is also a slightly different concern about the authority of bots. Is it going to be us or them who make the final call? For example, there are already bots out there that are designed to determine prison sentences. We already know that certain judges dish out harsher sentences just because they are in a foul mood for one reason or another. Because of that, some are in prison longer than others for the same crime. This raises an argument that judges should be replaced with bots instead for absolute justice. However, according to a study from ProPublica, some bots are designed to be biased against black people. The bot also considers the acquaintances of the defendant to determine the “risk score” of the defendant. It should go without saying that a person should not receive a more severe prison sentence just because he has friends who are also criminals. That would never be accepted as traditional evidence, yet the bot takes that into account as well.

There is also another problem with appealing. Should you appeal because the judge is not human? As of now, bots are just as, if not more, biased than human judges. If so, is there a fair and impartial decision-making body? When bots are implemented in the judicial system, what would their roles be in the Supreme Court?

Fake News and Fake Videos

We are already having a hard time dealing with fake news or misinformation. Machine learning is used to train bots so they can think of what kind of contents to show to different people. Because advertising models are used as a basis for most social media platforms, the main measure

of success is screen time. Our brain has developed to spot the bad things such as controversial topics, so those stories spread like wildfires even though they are biased. Humanity is now on the verge to create viral fake videos that are so realistic that many cannot tell them apart.

For instance, since fake news spread a lot faster than the real one, the former is about 80% more likely to be shared than the latter. So, many people are trying to influence major political events like elections or political opinions using fake news. A recent undercover investigation into Cambridge Analytica found that some people used fake news to influence elections. It is also widely reported that bots had a role in influencing the 2016 US Presidential Election by spreading political propaganda. These automated social media accounts are used to assist in the creation and dissemination of misinformation on the internet in an attempt to manipulate voters and fuel the fire of partisan disagreement.

AI is getting better and better at producing fake images, videos, conversations, as well as texts. Texts. Even without bots, people have enough problems believing everything they see, hear or read. What happens when the line between the genuine image and a fabricated one is blurred, when people can no longer tell the truth from the lies? Bots can work 24/7 and never tire, let alone make mistakes. So, they can generate a large amount of fake data in a very short time. These data can be shared among users in many social media platforms and flood them when they go viral even though the entire thing is a hoax. To make matters worse, when fake news goes viral, it is impossible to stop them. Bots can also spread false or heavily altered facts very effectively so they can be utilized to amplify messages, ultimately controlling people's minds.

The danger bots pose in this area is insurmountable. Criminals and

state actors can use fake images or audio to cause harm to everyone who would dare to interfere with their interests. Then, all it really takes is a few people to get the stone rolling and drastically change the public opinion and view.

With the knowledge that news can be fabricated easily, what can be accepted as a piece of genuine evidence in the courtroom? Is there really a way to slow down the spread of false information? Who decides if the news is true?

Both the governments and corporations should think about how they can withstand the damages caused by contents produced by AI. In reality, it can be wise to consider fake contents to be as malicious and dangerous as cybersecurity threats and respond accordingly. Propaganda, misinformation, malicious interference, blackmail, and other forms of information crime should be treated just as harmful as physical attacks or cyber-attacks on the systems and organizations. As it stands, the world is not prepared for the AI being unleashed on unprotected civilians. Corporations who freely traffic in user-generated content should be just as liable as governments to prevent the misuse of AI.

Transparency of Algorithms

Think of it as an extension from the previous ethical concern. Here, the companies are not willing to release their bots to the public for scrutiny. It is another problem that certain algorithms are obscure even to their creators because of the deep learning technology.

Deep learning is a growing technology under the machine learning umbrella that allows the bots to make accurate predictions. As explained before, we do not know how the bots make those predictions, which is another ethical concern.

For example, let us take a look at bots that are designed to monitor the performance of teachers. When bots fire underperforming teachers, they cannot explain exactly why the teachers are fired. They cannot produce a chart detailing the things that bots look for to fire a teacher. The best explanation anyone can give is by pointing to the data that had been fed to the bot.

So, the problem here is coming up of a way to balance the need for an accurate bot with the need for transparency for the people whose lives depend on it. When humanity is at a crossroad, everyone needs to choose between accuracy and transparency. Europe's new General Data Protection Regulation is a good example. If we are unaware of our own true motive for doing something, shouldn't bots be better at this?

Weapons

Weaponized AI is yet another ethical concerns. According to many AI researchers, it is possible to create lethal and autonomous weapon systems in less than ten years. AI can be used in drones to be deployed in the field and eliminate threats without confirmation from humans, which makes them a lot more dangerous than the current military drones.

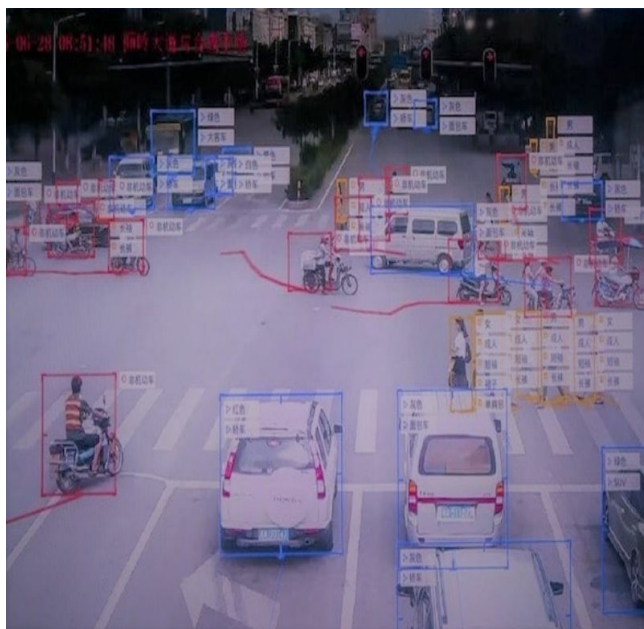


AI researchers have put together a video showcasing how small autonomous drones can be used to commit genocide. As a result, about 4,000 AI or robotic researchers have

signed an open letter asking for a ban on offensive autonomous weapons. These bots prove to be very lethal than nuclear weapons. There are also several questions associated with the control of bots as autonomous weapons. On what basis should these types of weapons be banned when every single state wants to use it to their advantage, at least as a bargaining chip? Even if the ban is possible, what measures should be taken to ensure that there is no secret development of such dangerous weapons?

Privacy and Surveillance

When there are many security cameras with facial recognition capability, there will be more ethical issues around surveillance. Bots can recognize people just by looking at their face and then track them as they move about. This is quite concerning. Before the development of facial recognition technology, even security cameras do not violate people's privacy because humans are required to keep an eye on the screen at all time, which is plain impossible. When bots, they can look at hundreds of footages at the same time.



For instance, China already started using its CCTV cameras to monitor the location of her citizens. Some

police also have special glasses with facial recognition software so they can get information about civilians they see on the street in real-time.

The question then would be whether there should be regulations against the use of such technologies. Because social change often starts as challenges to the status quo and civil disobedience, can such a capable technology lead to the loss of liberty and social change?



Microsoft urged Congress to study the technology further after learning that surveillance and facial recognition technologies can be so easily abused. Bradford Smith, the company's president, said that the government needs to play a critical role in regulating facial recognition technology because everyone is living in a nation of laws. The fact that tech giants do not usually advocate their innovations speaks volumes of the threat to liberty that surveillance and facial recognition technologies pose.

Autos

This is a widely popular concept for the use of bots. Tesla, Uber, Google, and many other car manufacturers are joining this technological race to create a fully capable bot that can drive better than a human. While that is not as hard to achieve, many ethical concerns are unresolved.

Back in March 2018, an Uber self-driving vehicle killed a pedestrian. There was a safety driver mode for emergencies, but it was not quick enough to stop the vehicle. In such a situation, who should be held responsible? Is it the company? Is it the drivers who should be watching? Is it the engineers who should ensure proper functions? If due to a software or hardware failure that make the car go too fast and the bot has to choose between running over people or fall off a cliff, what should the bot do? This is a widely debated topic, and some have even made the entire thing into a computer game. Moreover, when self-driving cars are more widely used, and its effectiveness is proven, should human-driving be outlawed?

Error Prevention

Whether it is a human or machine, intelligence needs to be developed through learning. The system learns to do what is right based on the inputs they receive, which is called the learning phase. After having been trained, these bots will go to a testing phase to see how it performs.

Because it is impossible to supply the bot with every single possible example out there, bots can still be fooled in ways that we cannot. If humanity relies on AI to bring about the major overhaul in the labor market, efficiency, and security, there should be a way to check whether those bots perform as intended and that people cannot abuse it for personal gain.

Ethical AI

Right now, there is a race to become a superpower in AI technology through technological breakthroughs to become the best AI developer. Many states like US, Singapore, Japan, Canada, and China are investing a lot of money into AI research and development. Behind the rush to continually improve AI's capacities, there is also a need for guidelines and standards to ensure that the research, development, and use of AI ethical. There is yet

another debate surrounding ethical AI. Should it make ethical decisions, or should there be some sort of regulations?

Challenges of AI

Advancements in AI technology is often seen as a benefit for us all. However, keep in mind that the belief that bots will inherently do good for the society is idealistic. To hold such a view would mean overlooking the critical research and development needed to create ethical and safe AI. As it stands, there is a lack of transparency for the data flow, and there has yet been a certification that guarantees AI safety.

A few issues have been identified with the data used in machine learning. The dataset to train the bots can be expensive to collect or purchase because not many people have access to the machine learning market. So, the data can be biased or full of errors about classes of individuals living in rural areas in low-income countries or those who chose to not share their data.

Even if the bots are trained using a proper dataset, there is still room to push the bot in the wrong direction by using the incorrect model or deliberately incorporating a discriminatory feature. Because there is no human oversight and involvement at this stage of machine learning, the system will be unpredictable and inscrutable.

Because engineers do not fully understand how their own bots even work, skewed results can be produced when the data that does not represent the whole population is used or when the bots are designed irresponsibly. This is known as the black box algorithms where the inputs and outputs are known, but the process is a mystery.

Where AI Messed Up

According to DeepMind researchers, AI can act aggressively. They

ran a test to study how AI would react when it is faced with certain social dilemmas.

In 2015, Google Photos mistakenly labeled two African American people as gorillas. A Microsoft Chatbot, Tay, made racist, inflammatory and political statements just an hour after its launch. Both caused public uproar. This opens the possibility that biases can be intentionally built into AI that has power over people's lives. Moreover, it is hard to know if a bot is behaving wrongly because we do not know the entire code. If a company does not want to hire women who might become pregnant, they can just use bots to filter those group of women out when they are hiring.

Bots have already implemented to achieve just that. Two multinational insurance companies in Mexico used bots to maximize their profit and efficiency, ignoring the possible implications for human rights to fair access to adequate healthcare. AI can be utilized in the future by gathering data like shopping history from the customers to understand their buying pattern so to determine if their lifestyle is high-risk and charge them more or deny them insurance coverage. Then, the poorest and sickest people will not be able to afford any healthcare services.

According to WEF report with 745 leaders surveyed in business, government, academia, NGO, and international organizations, AI is the only technology with the greatest potential to cause negative consequences over the coming decade.

What Has Been Done

Two years ago, Google, IBM, Amazon, Microsoft, Facebook, and other tech giants created an industry-led, non-profit consortium known as "Partnership on AI to Benefit People and Society" with the goal to find ethical standards for AI researchers in cooperation with academics and

specialists in policy and ethics. In addition to making sure that AI serves to benefit the society as a whole, this is also a move to calm the public down about the potential replacement of bots over humans. Just last year, other companies joined the party like Accenture and Mckinsey.

Many tech companies have taken steps to ensure that their technology is safe from the wrong hands. DeepMind has created its own Ethics & Society committee that will conduct research across six key themes like privacy, transparency, fairness as well as economic impact including inclusion and equality.

AETHER, a Microsoft's ethics board, is also looking to develop decision algorithms for the company's services in-cloud. Right now, the board only has Microsoft employees, but the company plans to have people outside to ensure that the bots they develop are truly ethical.

Conclusion

To sum up, it is inevitable that bots will come about, and they will revolutionize the job market. It is true that bots will take over some jobs, but that will not be the end of us. That bleak future will only occur only when we are unprepared. Thankfully, we have enough time to prepare if we take action now. To secure a bright future, we need to develop an ethical code for those bots in addition to newer legislations to control the development, deployment, and function of bots.

#####